United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with the
Minnesota Agricultural
Experiment Station

Soil Survey of Marshall County, Minnesota

Part I

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How to Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, the survey area is divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** in Part I of this survey for a general description of the soils in your area.

The **detailed soil maps** can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet, and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** in Part I of this survey, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** in Part II shows which table has data on a specific land use for each detailed soil map unit. See the **Contents** in Part I and Part II for other sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in November 1992. Soil names and descriptions were approved in September 1994. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service and the Minnesota Agricultural Experiment Station. Assistance was provided by the Agriculture Extension Service, Minnesota Department of Natural Resources, and the Board of Water and Soil Resources. The survey was partially funded by the Legislative Commission for Minnesota Resources and by Marshall County. It is part of the technical assistance furnished to the Marshall County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

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Cover: Several conservation practices are visible on this farmstead east of Argyle in Marshall County. Field windbreaks and conservation tillage reduce the hazard of soil blowing in an area of the Wheatville-Glyndon association. Crop rotations help to control erosion and maintain soil fertility.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov (click on "Technical Resources").

Contents

How to Use This Soil Survey 3
Index to Series 6
Index to Map Units 7
Foreword 9
How This Survey Was Made 11
General Nature of the Survey Area 12
Tables:
Temperature and Precipitation 15
Freeze Dates in Spring and Fall 16
Growing Season 16
General Soil Map Units 17
1. Wahpeton-Fargo Association 17
2. Colvin-Bearden Association 17
3. Northcote-Eaglepoint Association 18
4. Fargo-Colvin-Hegne Association 19
5. Wheatville-Glyndon Association 19
6. Ulen-Flaming Association 19
7. Sandberg-Strathcona-Syrene Association 20
8. Grimstad-Strathcona-Vallers Association 22
9. Percy-Strathcona-Mavie Association 22
10. Roliss-Vallers-Mavie Association 23
11. Karlstad-Deerwood-Syrene Association ... 24
12. Redby-Northwood-Cormant Association ... 24
13. Smiley-Kratka-Reiner Association 25
14. Clearwater-Wyandotte Association 26
15. Cathro-Dora-Wildwood Association 28
Formation and Classification of the Soils 29
Tables:
Classification of the Soils 32
Acreage and Proportionate Extent of the Soils 34
Soil Series and Detailed Soil Map Units 37
References 135
Glossary 137

Issued 2000

Index to Series

Augsburg series 38
Bearden series 39
Berner series 41
Boash series 43
Borup series 44
Cathro series 45
Clearriver series 46
Clearwater series 47
Colvin series 50
Corliss series 51
Cormant series 52
Deerwood series 53
Dora series 54
Eaglepoint series 55
Eckvoll series 57
Enstrom series 58
Espelie series 59
Fargo series 60
Flaming series 62
Foldahl series 63
Foxhome series 64
Garnes series 65
Glyndon series 66
Grimstad series 68
Grygla series 69
Hamar series 70
Hamerly series 71
Hamre series 72
Hangaard series 73
Haug series 74
Hegne series 76
Hilaire series 77
Huot series 78
Karlstad series 79
Kittson series 80
Kratka series 81
Lamoure series 82
Linveldt series 84
Lupton series 85
Markey series 86
Marquette series 90
Mavie series 91
Nereson series 92
Newfolden series 94
Northcote series 95
Northwood series 96
Pelan series 97
Percy series 99
Poppleton series 101
Radium series 102
Redby series 103
Reiner series 104
Reis series 106
Rifle series 106
Roliss series 107
Rosewood series 109
Rushlake series 112
Sahkahtay series 113
Sandberg series 114
Seelyeville series 115
Skagen series 116
Smiley series 118
Strandquist series 119
Strathcona series 120
Syrene series 122
Tacoosh series 123
Thiefriver series 124
Ulen series 125
Vallers series 127
Wahpeton series 128
Wheatville series 129
Wildwood series 130
Wyandotte series 132

Index to Map Units

47—Colvin silty clay loam 50
57A—Fargo silty clay, 0 to 2 percent slopes 61
58—Kittson loam 81
59—Grimstad fine sandy loam 68
65—Foxhome sandy loam 65
66—Flaming loamy fine sand 62
67A—Bearden silt loam, 0 to 2 percent slopes 40
67B—Bearden silt loam, 2 to 6 percent slopes 40
77—Garnes fine sandy loam 66
93A—Bearden silty clay loam, 0 to 2 percent slopes 40
111—Hangaard sandy loam 74
116—Redby loamy fine sand 104
117—Cormant loamy fine sand 53
145—Enstrom loamy fine sand 59
148—Poppleton fine sand 102
157A—Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded 128
157B—Wahpeton silty clay, 2 to 6 percent slopes, occasionally flooded 128
184A—Hamerly loam, 0 to 3 percent slopes 71
187—Haug muck 75
205—Karlstad loamy sand 80
236—Vallers loam 127
242B—Marquette loamy sand, 1 to 8 percent slopes 91
258B—Sandberg loamy sand, 1 to 6 percent slopes 114
280—Pelan sandy loam 98
372—Hamar loamy fine sand 70
379—Percy loam, very cobbly 99
383—Percy loam 100
384—Percy mucky loam, depressional 100
387—Roliss loam, depressional 108
412—Mavie fine sandy loam 92
418—Lamoure silty clay loam, occasionally flooded 83
426—Foldahl loamy fine sand 64
429A—Northcote clay, 0 to 2 percent slopes 96
432—Strandquist loam 120
435—Syrene sandy loam 123
439—Strathcona fine sandy loam 121
481—Kratka fine sandy loam 82
482—Grygla loamy fine sand 69
514—Tacoosh muck 124
540—Seelyeville muck 115
541—Rifle mucky peat 107
543—Markey muck 86
544—Cathro muck 45
546—Lupton muck 85
547—Deerwood muck 54
550—Dora muck 55
563—Northwood muck 97
565—Eckvoll loamy fine sand 58
582—Roliss loam 108
583—Nereson fine sandy loam 93
630—Wildwood muck 131
641—Clearwater clay 48
642—Clearwater loam 48
643—Huot fine sandy loam 79
644—Boash clay loam 43
645—Espelie fine sandy loam 60
647—Hilaire loamy fine sand 77
648—Newfolden loam 94
649—Reiner loamy fine sand 105
650—Reiner fine sandy loam 105
651—Thiefriver fine sandy loam 125
652—Wyandotte clay loam 132
653—Smiley mucky loam, depressional 119
708—Rushlake loamy sand 112
712—Rosewood fine sandy loam 110
713—Linveldt fine sandy loam 84
721B—Corliss loamy sand, 1 to 6 percent slopes 52
765—Smiley loam 119
794—Clearriver loamy fine sand 47
935—Hegne-Fargo complex 76
936—Clearwater-Reis complex 49
937—Eaglepoint-Northcote complex 56
972—Roliss-Vallers complex 109
1006—Fluvaquents-Haploborolls complex, 0 to 30 percent slopes, flooded 63
1030—Pits, gravel-Udipsamments complex 101
1031—Seelyeville muck, ponded 116
1143—Berner-Markey complex 42
1144—Strathcona and Kratka soils, depressional 122
1146—Northwood muck, ponded 97

1158—Skagen loam 117
1170—Skagen loam, very cobbly 117
1187—Dora muck, ponded 55
1188—Wildwood muck, ponded 131
1189—Clearwater mucky loam, depressional 49
1191—Sahkahtay sandy loam 113
1264—Ulen loamy fine sand 126
1297—Augsburg very fine sandy loam 39
1299—Borup very fine sandy loam 44
1304A—Glyndon very fine sandy loam, 0 to 2 percent slopes 67
1304B—Glyndon very fine sandy loam, 2 to 6 percent slopes 67
1315A—Wheatville very fine sandy loam, 0 to 2 percent slopes 130
1804—Hamre muck, ponded 73
1807—Cathro muck, ponded 46
1808—Markey muck, ponded 90
1871—Fargo silty clay, swales 61
1874—Radium loamy sand 103
1878—Hamre muck 72
1882—Rosewood, Strathcona, and Berner soils, seepy 110
1963—Bearden-Colvin complex 41
1964—Colvin-Fargo complex 51
1966—Rosewood-Hamar complex 111

Foreword

This soil survey contains information that can be used in land-planning programs in Marshall County, Minnesota. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service.

William Hunt
State Conservationist
Natural Resources Conservation Service

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Soil Survey of
Marshall County, Minnesota

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United States Department of Agriculture, Natural Resources Conservation Service,
in cooperation with the
Minnesota Agricultural Experiment Station

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, soil scientists develop a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

General Nature of the Survey Area

Marshall County is in northwestern Minnesota (fig. 1). Warren is the county seat. The total area of the county is 1,160,100 acres, or about 1,813 square miles. Farming is the principal business enterprise. Small grain, beans, hay, sunflowers, sugar beets, potatoes, and soybeans are the main crops. Dairy farming is the main livestock enterprise.

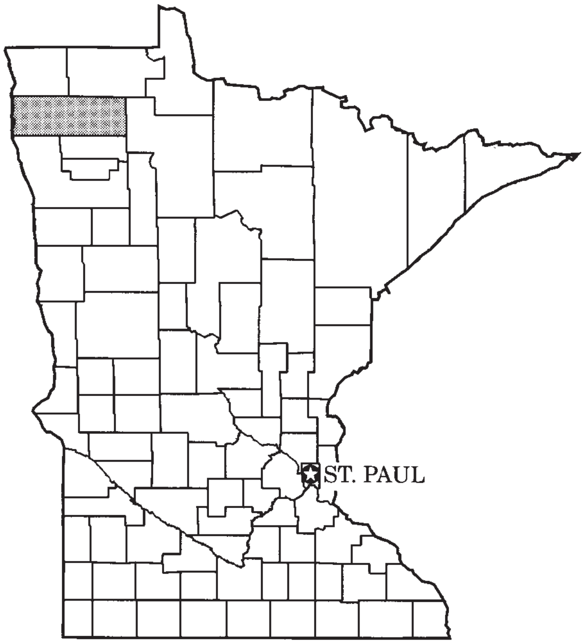

Figure 1.—Location of Marshall County in Minnesota.

The soils in Marshall County formed on a glacial lake plain (Glacial Lake Agassiz). They are mainly dark and formed under wet prairie grasses and sedges. Forest vegetation encroached into the county from the east. The soils in the north-central and eastern one-third of Marshall County show the influence of forest vegetation on soil profile development.

This soil survey updates the Red River Valley (reconnaissance) soil survey published in 1939 (Nikiforoff, 1939). It provides additional information and has larger maps, which show the soils in greater detail.

History and Development

The Marshall County Historical Society helped prepare this section.

Marshall County was established on February 25, 1879, when the Minnesota Legislature divided Kittson County. The county is named after William Rainy Marshall, who served as Governor of Minnesota from 1866 to 1870. Marshall, a native of Missouri, became a pioneer hardware merchant in the newly organized Minnesota Territory in 1849. He served in the Civil War and was promoted to brigadier general.

The first permanent settler in the survey area was Michael "Tamarac Mac" McCullough. In 1871, McCullough staked a claim to 160 acres along the Tamarac River near the present town of Stephen.

Agriculture, especially the production of wheat, and sawmills were of paramount importance when the county was established, but the economic base has expanded over the years. Farming is still the major economic factor in the county, but industry and manufacturing are also important.

The population of Marshall County was 12,800 in 1980. It was 10,993 in 1990.

Transportation Facilities and Markets

In the first half of the 19th century, transportation was by way of the Pembina Trail. Oxcarts traveling the Pembina Trail brought trade goods into the county. This trail and the oxcart trade routes formed the basis of the state's first highway system, the Red River Trails.

Today the Soo Line Railroad and the Burlington Northern Railroad cross the county from north to south. The Soo Line also crosses the western two-thirds of the county in an east-west direction.

A network of all-weather roads serves the county. The major roads are State Highways 220, 32, 89, 219, and 1 and U.S. Highways 75 and 59.

Grain is hauled to local elevators and then shipped by rail or trucks to Duluth or Minneapolis. Large quantities of grain may be stored on the farm. Sugar beets are transported by truck to Drayton, North Dakota, or East Grand Forks for processing. Much of the potato crop is marketed locally. Some potatoes are shipped to Minneapolis. Dairy products are marketed locally or in adjacent counties. Slaughter or feeder animals are shipped by truck to West Fargo, to Winger, Minnesota, or to South St. Paul.

Wheat, barley, and oats are the major grain crops. Potatoes and sugar beets are also grown. Potatoes are grown on the coarser textured soils. Sugar beets are grown largely on the medium and fine textured soils in the western part of the county. Soybeans and sunflowers are other important crops. Acreages of these crops fluctuate with current markets. Hay for livestock feed is produced in the eastern two-thirds of the county. Some dairy and livestock operations are throughout the county.

Physiography, Relief, and Drainage

All of Marshall County has been influenced by the waters of Glacial Lake Agassiz. In the western part of the county, where the glacial water was deep, the soils are clayey. In the areas to the east, away from the Red River, progressively coarser particles settled out, grading from clay, silt, very fine sand, fine sand, and sand to gravel. As the water level of the lake receded, a succession of beach ridges formed. These beach ridges range in texture from coarse-silty material on the wide, almost unnoticeable beach ridge at the eastern edge of the Red River Valley to sandy and gravelly material on the prominent ridges in the central and eastern parts of the county. In the eastern part of Marshall County, the water was shallow and covered the area for a relatively short period of time. The deposited lake sediment is very thin over glacial till deposits. The evidence of sorting action by waves is apparent in the concentration of stones and boulders at or near the surface of the soils in the north-central part of the county (Hobbs and Goebel, 1982).

The highest elevation in Marshall County, 1,225 feet above sea level, is on the beach ridges in the northeastern one-third of the county near Thief Lake. The lowest point is 770 feet above sea level in the northwest corner, where the Red River leaves the county. The maximum difference in elevation from the northeast to the northwest is approximately 455 feet. The slope gradient in the western part of the county ranges from 1 to 3 feet per mile (Arndt, 1977).

The drainage of Marshall County can be divided into two main areas—the eastern one-third and the western two-thirds. The eastern section drains to the south. This section is drained in the north by the Moose River, which empties into Thief Lake. The middle part of the eastern section is drained by the Mud River, which empties into Mud Lake. Both Thief Lake and Mud Lake are drained by the Thief River, which flows south into adjoining Pennington County. The Mud and Thief Rivers have been partially diverted and channelized, especially in the area of the Agassiz National Wildlife Refuge. The U.S. Fish and Wildlife Service operates a water management system that benefits the wildlife in the area.

The western two-thirds of Marshall County drains to the west. This section is drained in the north by the Tamarac River. The central part is drained by the Middle River. The southern part is drained by the Snake River, which flows southwest into Polk County for several miles and then north in Marshall County where it is joined by the Middle River. All of the rivers and tributaries in the western portion empty into the Red River of the North, which flows north along the extreme western edge of the county. Natural creeks and drainageways and an extensive system of legal ditches and agricultural drainage systems remove excess water from farming and residential areas.

Climate

The three tables at the end of this section provide climate data for the survey area as recorded at Argyle in the period 1961 to 1990.

In winter, the average temperature is 5 degrees F and the average daily minimum temperature is -5 degrees. The lowest temperature on record, which occurred at Argyle on January 21, 1954, is -41 degrees. In summer, the average temperature is 66 degrees and the average daily maximum temperature is 79 degrees. The highest temperature, which occurred at Argyle on July 6, 1988, is 105 degrees.

Growing degree days are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 18.8 inches. Of this, about 13.8 inches, or 73 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 4.72 inches at Argyle on July 2, 1975. Thunderstorms occur on about 32 days each year, and most occur in July.

The average seasonal snowfall is 38.5 inches. The greatest snow depth at any one time during the period of record was 38 inches. On an average, 12 days per year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 11.1 inches.

The average relative humidity in midafternoon is about 62 percent. Humidity is higher at night, and the average at dawn is about 81 percent. The sun shines about 67 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 14 miles per hour, in April.

Temperature and Precipitation

(Recorded in the period 1961-90 at Argyle, Minnesota)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	11.9	-9.4	1.2	40	-36	0	0.89	0.40	1.37	3	10.6
February---	18.0	-4.4	6.8	43	-33	0	.59	.28	.87	2	6.3
March------	31.9	11.1	21.5	60	-24	7	.95	.30	1.49	3	7.2
April------	51.5	28.6	40.0	83	1	122	1.37	.63	2.30	3	1.5
May--------	67.8	40.8	54.3	93	22	428	2.10	1.00	3.05	5	.2
June-------	76.0	50.4	63.2	94	34	676	3.08	1.69	4.31	6	.0
July-------	81.5	54.9	68.2	97	40	848	2.85	1.48	4.05	5	.0
August-----	80.3	51.9	66.1	99	35	780	2.13	1.04	3.07	5	.0
September--	68.6	42.3	55.5	93	23	451	2.28	1.00	3.37	4	.0
October----	55.5	31.7	43.6	82	12	171	1.26	.43	1.94	3	.5
November---	34.6	16.2	25.4	63	-13	14	.71	.38	1.25	2	5.3
December---	17.9	-1.4	8.2	46	-30	0	.59	.24	1.04	1	6.9
Yearly:											
Average---	49.6	26.1	37.8	---	---	---	---	---	---	---	---
Extreme---	105	-41	---	100	-37	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,497	18.80	13.61	22.26	42	38.5

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Argyle, Minnesota)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 13	May 21	May 31
2 years in 10 later than--	May 7	May 16	May 26
5 years in 10 later than--	Apr. 25	May 7	May 17
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 24	Sept. 17	Sept. 6
2 years in 10 earlier than--	Sept. 29	Sept. 22	Sept. 10
5 years in 10 earlier than--	Oct. 10	Oct. 1	Sept. 19

Growing Season

(Recorded in the period 1961-90 at Argyle, Minnesota)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	135	124	103
8 years in 10	144	130	110
5 years in 10	160	142	124
2 years in 10	175	154	137
1 year in 10	184	161	144

General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

1. Wahpeton-Fargo Association

Level to gently sloping, moderately well drained and poorly drained soils on flood plains and lake plains

Setting

Landform: Terraces adjacent to large streams and rivers and lake plains
Slope range: 0 to 6 percent

Composition

Percent of the survey area: 2
Extent of the components in the association:
  Wahpeton soils: 50 percent
  Fargo soils: 40 percent
  Soils of minor extent: 10 percent

Soil Properties and Qualities

Wahpeton

Drainage class: Moderately well drained
Position on the landform: Flats, slight rises, and rises
Parent material: Alluvium
Surface texture: Silty clay

Fargo

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Glaciolacustrine deposits
Surface texture: Silty clay

Minor Soils

- The poorly drained Colvin and Hegne soils on flats and slight rises

Use and Management

Major use: Cropland

2. Colvin-Bearden Association

Level to gently sloping, poorly drained to moderately well drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 6 percent

Composition

Percent of the survey area: 2
Extent of the components in the association (fig. 2):
  Colvin soils: 45 percent
  Bearden soils: 40 percent
  Soils of minor extent: 15 percent

Soil Properties and Qualities

Colvin

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Glaciolacustrine deposits
Surface texture: Silty clay loam

Bearden

Drainage class: Somewhat poorly drained and moderately well drained
Position on the landform: Flats, slight rises, and backslopes
Parent material: Glaciolacustrine deposits

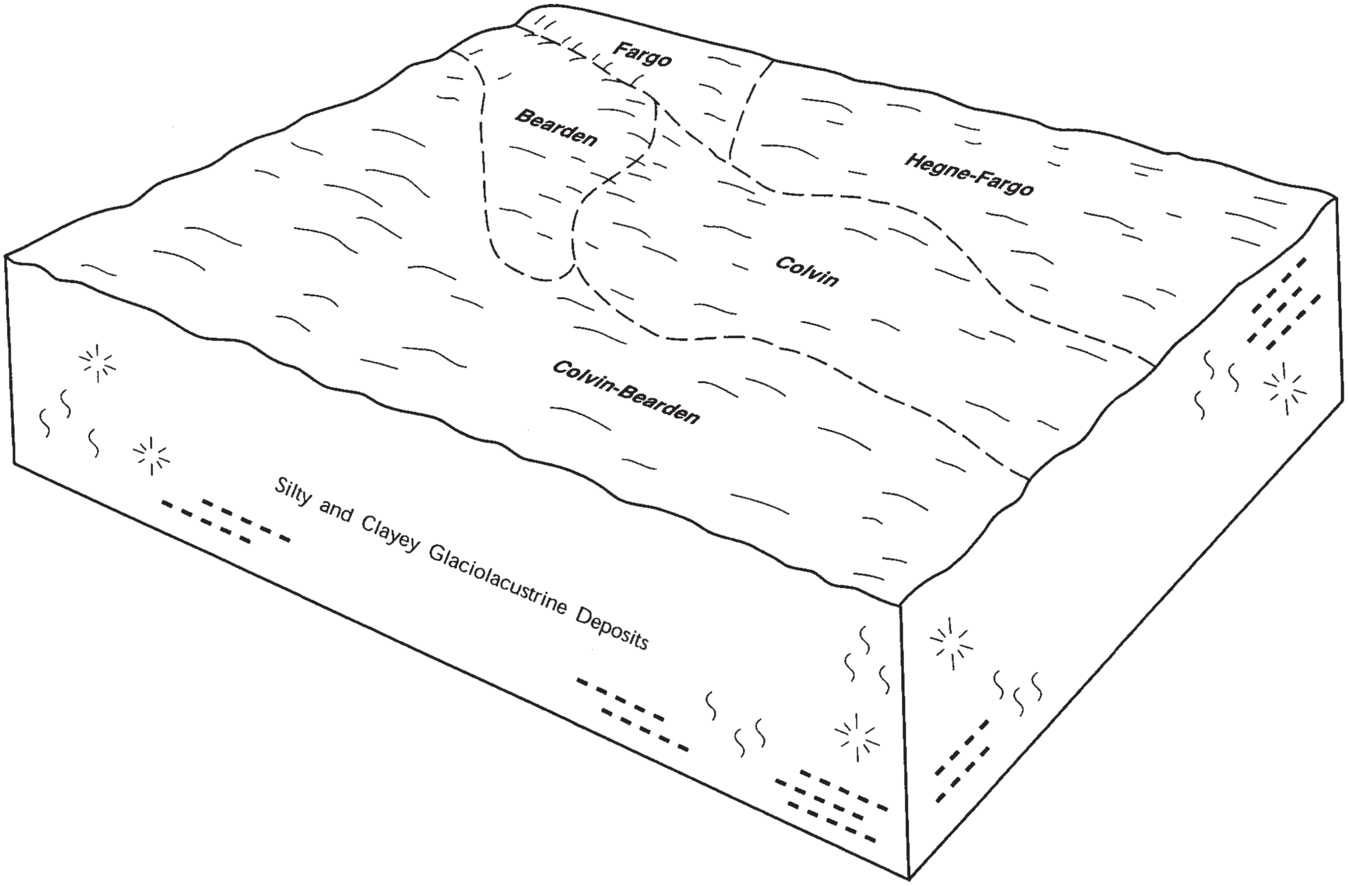

Figure 2.—Typical pattern of soils and underlying material in the Colvin-Bearden association.

Surface texture: Silty clay loam, silt loam

Minor Soils

- The poorly drained Fargo soils on flats and in swales
- The poorly drained Hegne soils on flats and slight rises

Use and Management

Major use: Cropland

3. Northcote-Eaglepoint Association

Level and nearly level, poorly drained and somewhat poorly drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 2 percent

Composition

Percent of the survey area: 4

Extent of the components in the association:
Northcote soils: 65 percent
Eaglepoint soils: 20 percent
Soils of minor extent: 15 percent

Soil Properties and Qualities

Northcote

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Glaciolacustrine deposits
Surface texture: Clay

Eaglepoint

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits
Surface texture: Clay

Minor Soils

- The poorly drained Fargo soils on flats
- The poorly drained Hegne and Colvin soils on flats and slight rises

- The moderately well drained and somewhat poorly drained Bearden soils on slight rises

Use and Management

Major use: Cropland

4. Fargo-Colvin-Hegne Association

Level and nearly level, poorly drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 2 percent

Composition

Percent of the survey area: 18
Extent of the components in the association:
  Fargo soils: 50 percent
  Colvin soils: 20 percent
  Hegne soils: 15 percent
  Soils of minor extent: 15 percent

Soil Properties and Qualities

Fargo

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Glaciolacustrine deposits
Surface texture: Silty clay

Colvin

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits
Surface texture: Silty clay loam

Hegne

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits
Surface texture: Silty clay

Minor Soils

- The moderately well drained and somewhat poorly drained Bearden and Wheatville soils on slight rises
- The poorly drained Lamoure soils on flood plains

Use and Management

Major use: Cropland

5. Wheatville-Glyndon Association

Level to gently sloping, moderately well drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 6 percent

Composition

Percent of the survey area: 4
Extent of the components in the association (fig. 3):
  Wheatville soils: 50 percent
  Glyndon soils: 30 percent
  Soils of minor extent: 20 percent

Soil Properties and Qualities

Wheatville

Drainage class: Moderately well drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits
Surface texture: Very fine sandy loam

Glyndon

Drainage class: Moderately well drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits
Surface texture: Very fine sandy loam

Minor Soils

- The poorly drained Augsburg and Borup soils on flats
- The poorly drained Clearwater soils on flats and in swales
- The moderately well drained Huot soils on slight rises

Use and Management

Major use: Cropland

6. Ulen-Flaming Association

Level to gently sloping, moderately well drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 3 percent

Composition

Percent of the survey area: 5

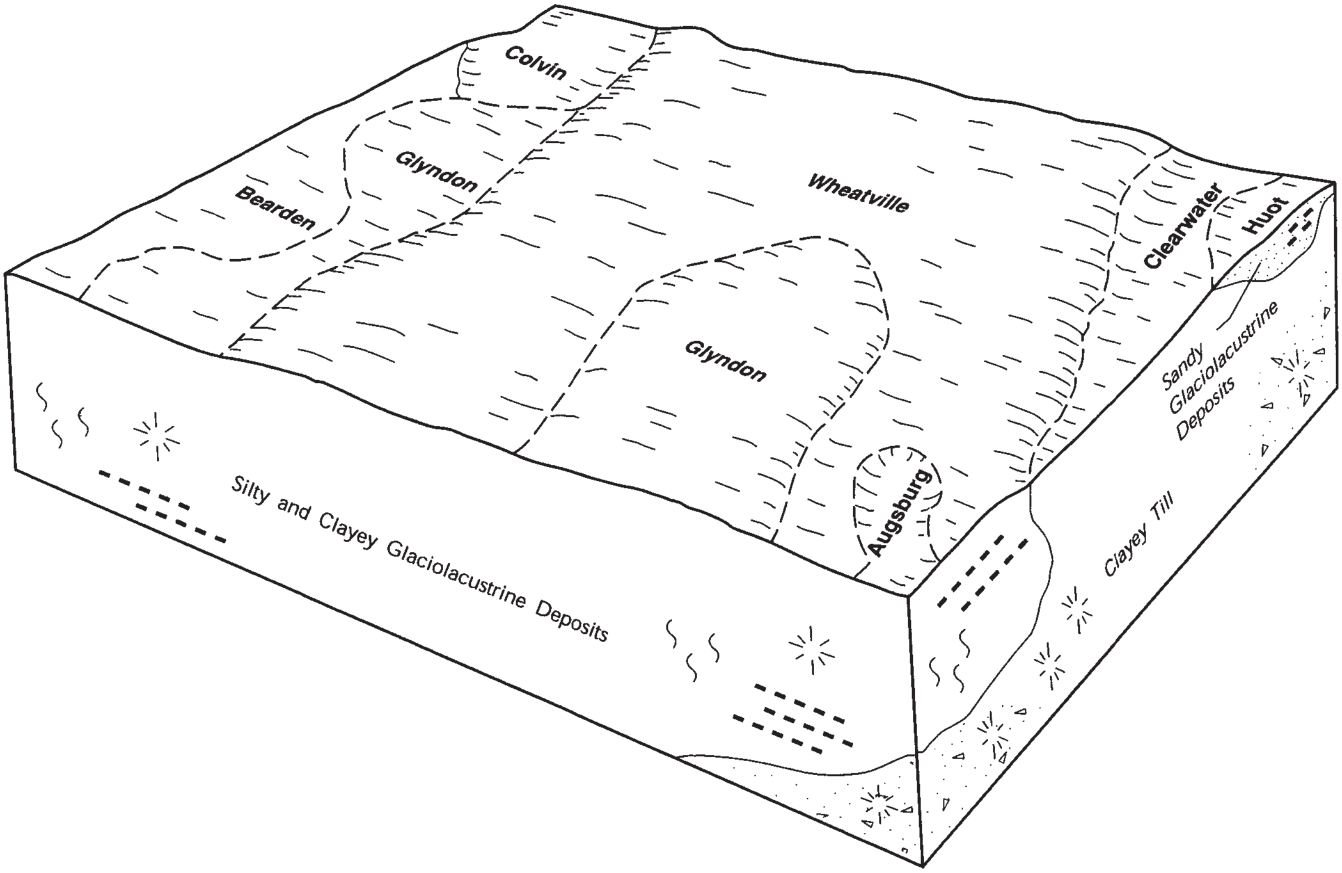
Colvin
Glyndon
Bearden
Wheatville
Clearwater
Huot
Glyndon
Augsburg
Sandy Glaciolacustrine Deposits
Silty and Clayey Glaciolacustrine Deposits
Clayey Till

Figure 3.—Typical pattern of soils and underlying material in the Wheatville-Glyndon association.

Extent of the components in the association:
Ulen soils: 55 percent
Flaming soils: 30 percent
Soils of minor extent: 15 percent

Soil Properties and Qualities

Ulen

Drainage class: Moderately well drained
Position on the landform: Slight rises
Parent material: Glaciolacustrine deposits
Surface texture: Loamy fine sand

Flaming

Drainage class: Moderately well drained
Position on the landform: Slight rises
Parent material: Glaciolacustrine deposits
Surface texture: Loamy fine sand

Minor Soils

- The poorly drained Rosewood and Strathcona soils on flats and slight rises
- The poorly drained Hamar soils on flats and in swales
- The moderately well drained Foldahl, Grimstad, and Huot soils on slight rises

Use and Management

Major use: Cropland

7. Sandberg-Strathcona-Syrene Association

Level to gently sloping, excessively drained to poorly drained soils on lake plains and beach ridges

Setting

Landform: Beach ridges, lake plains, and beach plains
Slope range: 0 to 6 percent

Composition

Percent of the survey area: 4

Extent of the components in the association (fig. 4):
Sandberg soils: 25 percent
Strathcona soils: 25 percent
Syrene soils: 15 percent
Soils of minor extent: 35 percent

Soil Properties and Qualities

Sandberg

Drainage class: Excessively drained
Position on the landform: Summits and backslopes
Parent material: Beach deposits
Surface texture: Loamy sand

Strathcona

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam

Syrene

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Beach deposits
Surface texture: Sandy loam

Minor Soils

- The very poorly drained Deerwood and Northwood soils in depressions
- The poorly drained Hamar soils on flats and in swales
- The poorly drained Mavie and Rosewood soils on flats and slight rises
- The moderately well drained Flaming, Foldahl, Grimstad, Radium, and Ulen soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture

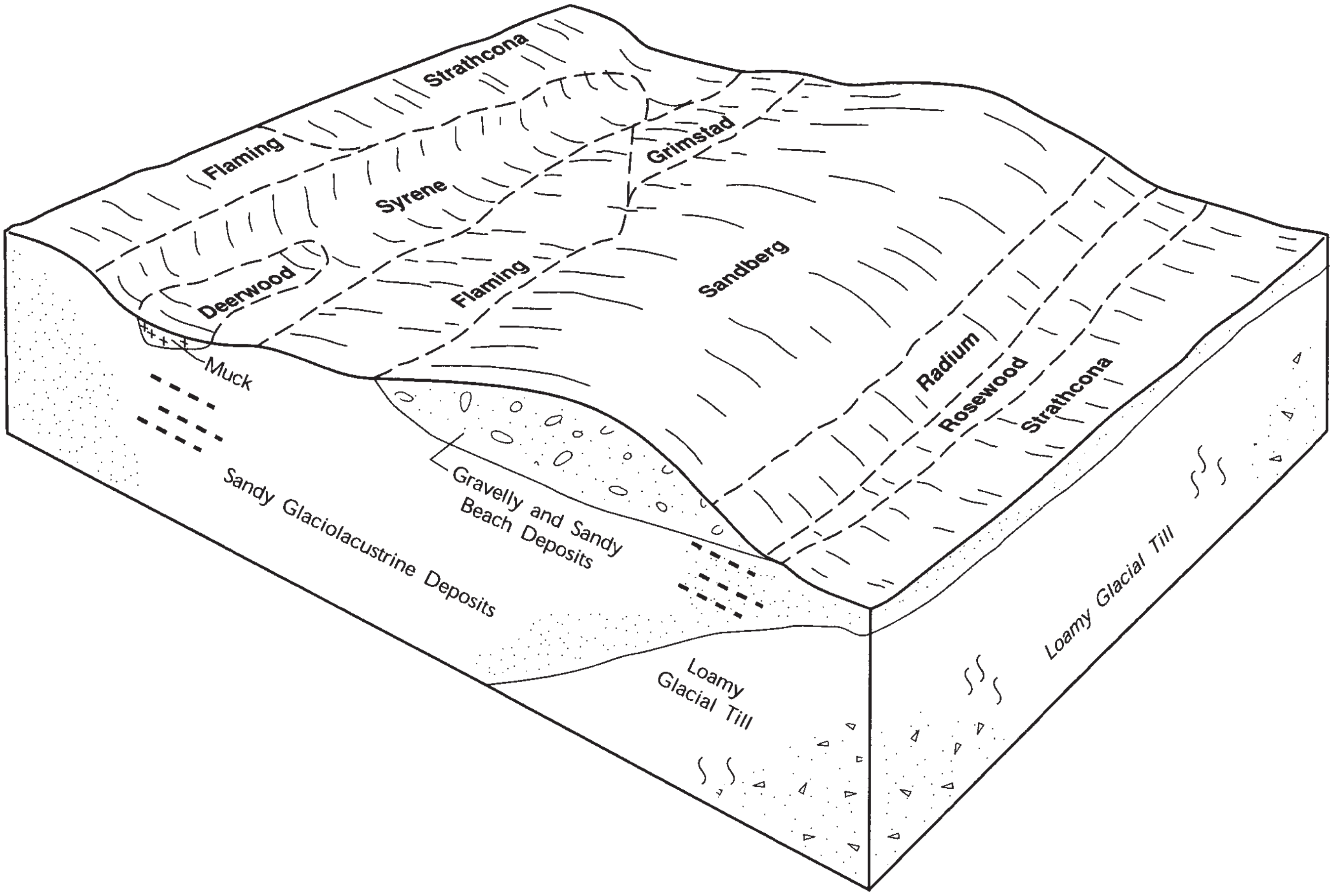
Strathcona
Flaming
Syrene
Grimstad
Deerwood
Flaming
Sandberg
Radium
Rosewood
Strathcona
Muck
Sandy Glaciolacustrine Deposits
Gravelly and Sandy Beach Deposits
Loamy Glacial Till
Loamy Glacial Till

Figure 4.—Typical pattern of soils and underlying material in the Sandberg-Strathcona-Syrene association.

8. Grimstad-Strathcona-Vallers Association

Level to gently sloping, moderately well drained to poorly drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 3 percent

Composition

Percent of the survey area: 9
Extent of the components in the association:
Grimstad soils: 40 percent
Strathcona soils: 15 percent
Vallers soils: 15 percent
Soils of minor extent: 30 percent

Soil Properties and Qualities

Grimstad

Drainage class: Moderately well drained
Position on the landform: Slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam

Strathcona

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam

Vallers

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Till
Surface texture: Loam

Minor Soils

- The poorly drained Kratka soils on flats and in swales
- The poorly drained Mavie and Rosewood soils on flats and slight rises
- The moderately well drained Foldahl, Flaming, Huot, Ulen, and Wheatville soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture

9. Percy-Strathcona-Mavie Association

Level and nearly level, poorly drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 2 percent

Composition

Percent of the survey area: 6
Extent of the components in the association:
Percy soils: 25 percent
Strathcona soils: 20 percent
Mavie soils: 20 percent
Soils of minor extent: 35 percent

Soil Properties and Qualities

Percy

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Till
Surface texture: Loam

Strathcona

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam

Mavie

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam

Minor Soils

- The very poorly drained Haug and Northwood soils in depressions
- The poorly drained Kratka, Smiley, and Strandquist soils on flats and in swales
- The poorly drained Syrene soils on flats and slight rises
- The moderately well drained Foxhome, Nereson, Pelan, and Skagen soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture

10. Roliss-Vallers-Mavie Association

Level and nearly level, poorly drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 2 percent

Composition

Percent of the survey area: 12
Extent of the components in the association (fig. 5):
  Roliss soils: 25 percent
  Vallers soils: 20 percent
  Mavie soils: 20 percent
  Soils of minor extent: 35 percent

Soil Properties and Qualities

Roliss

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Till
Surface texture: Loam

Vallers

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Till
Surface texture: Loam

Mavie

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam

Minor Soils

- The very poorly drained Hamre, Northwood, and Cathro soils in depressions
- The poorly drained Kratka and Smiley soils on flats and in swales
- The poorly drained Strathcona soils on flats and slight rises
- The moderately well drained Foldahl, Grimstad,

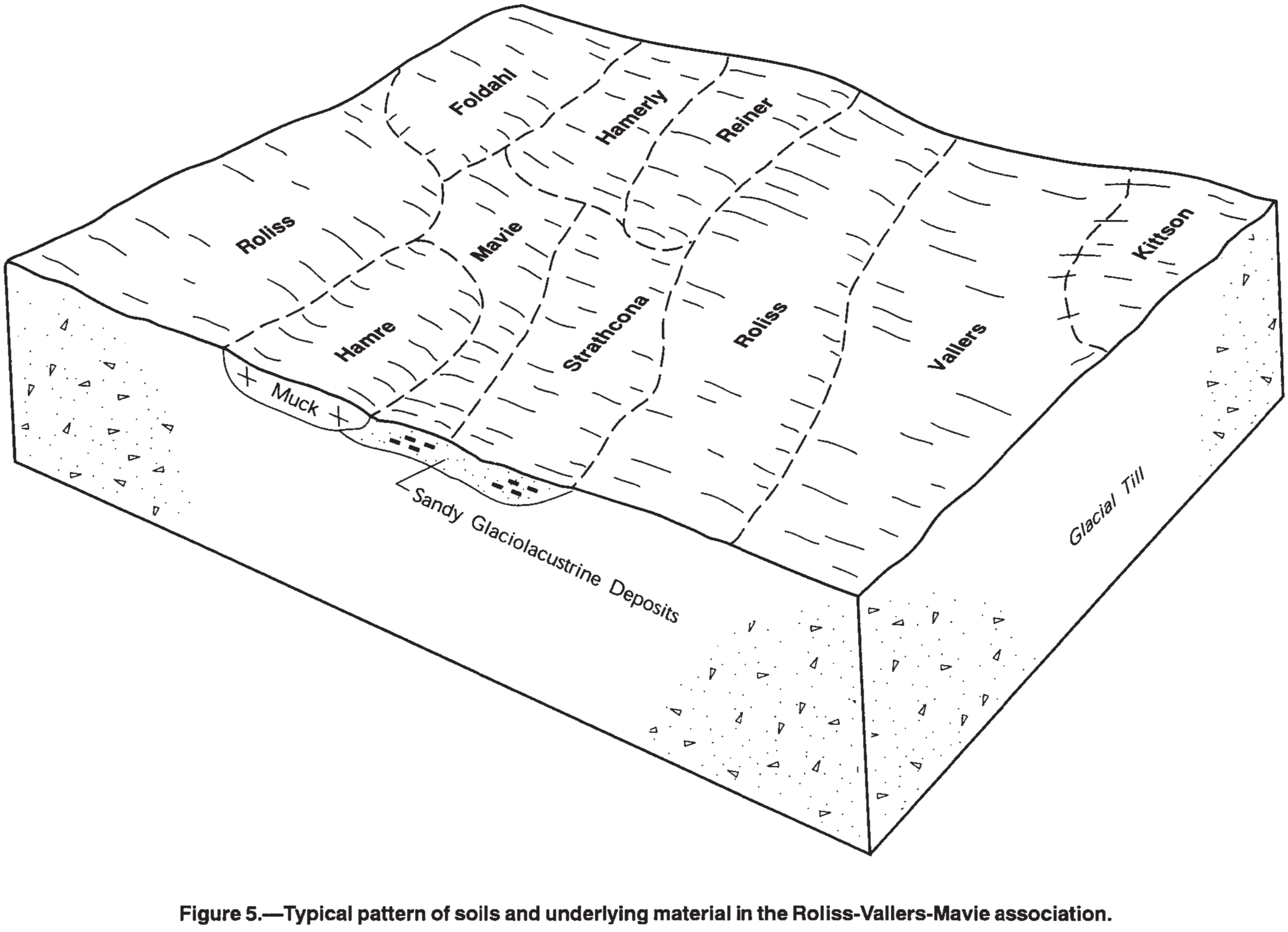

Figure 5.—Typical pattern of soils and underlying material in the Roliss-Vallers-Mavie association.

Hamerly, Kittson, Pelan, and Reiner soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture

11. Karlstad-Deerwood-Syrene Association

Level to gently sloping, very poorly drained to moderately well drained soils on lake plains and beach plains

Setting

Landform: Lake plains and beach plains
Slope range: 0 to 3 percent

Composition

Percent of the survey area: 5
Extent of the components in the association:
Karlstad soils: 35 percent
Deerwood soils: 30 percent
Syrene soils: 15 percent
Soils of minor extent: 20 percent

Soil Properties and Qualities

Karlstad

Drainage class: Moderately well drained
Position on the landform: Slight rises
Parent material: Beach deposits
Surface texture: Loamy sand

Deerwood

Drainage class: Very poorly drained
Position on the landform: Depressions
Parent material: Organic materials and glaciolacustrine deposits
Surface texture: Muck

Syrene

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Beach deposits
Surface texture: Sandy loam

Minor Soils

- The very poorly drained Markey and Northwood soils in depressions
- The poorly drained Strathcona and Strandquist soils on flats and in swales
- The somewhat poorly drained Redby soils on slight rises
- The moderately well drained Clearriver and Enstrom soils on slight rises
- The excessively drained Corliss and Marquette soils on summits and backslopes

Use and Management

Major uses: Cropland, forage, pasture, and woodland

12. Redby-Northwood-Cormant Association

Level to gently sloping, somewhat poorly drained to very poorly drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 3 percent

Composition

Percent of the survey area: 1
Extent of the components in the association:
Redby soils: 30 percent
Northwood soils: 25 percent
Cormant soils: 10 percent
Soils of minor extent: 35 percent

Soil Properties and Qualities

Redby

Drainage class: Somewhat poorly drained
Position on the landform: Slight rises
Parent material: Glaciolacustrine deposits
Surface texture: Loamy fine sand

Northwood

Drainage class: Very poorly drained
Position on the landform: Depressions
Parent material: Organic materials and glaciolacustrine deposits or till
Surface texture: Muck

Cormant

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Glaciolacustrine deposits
Surface texture: Loamy fine sand

Minor Soils

- The very poorly drained Deerwood soils in depressions
- The poorly drained Grygla and Kratka soils on flats and in swales
- The poorly drained Rosewood and Strathcona soils on flats and slight rises

- The moderately well drained Clearriver soils on slight rises

Use and Management

Major uses: Woodland, cropland, and pasture

13. Smiley-Kratka-Reiner Association

Level to gently sloping, poorly drained to moderately well drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 3 percent

Composition

Percent of the survey area: 17
Extent of the components in the association (fig. 6):
  Smiley soils: 35 percent
  Kratka soils: 20 percent
  Reiner soils: 10 percent
  Soils of minor extent: 35 percent

Soil Properties and Qualities

Smiley

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Till
Surface texture: Loam

Kratka

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Glaciolacustrine deposits and till
Surface texture: Fine sandy loam

Reiner

Drainage class: Moderately well drained
Position on the landform: Slight rises
Parent material: Till
Surface texture: Fine sandy loam, loamy fine sand

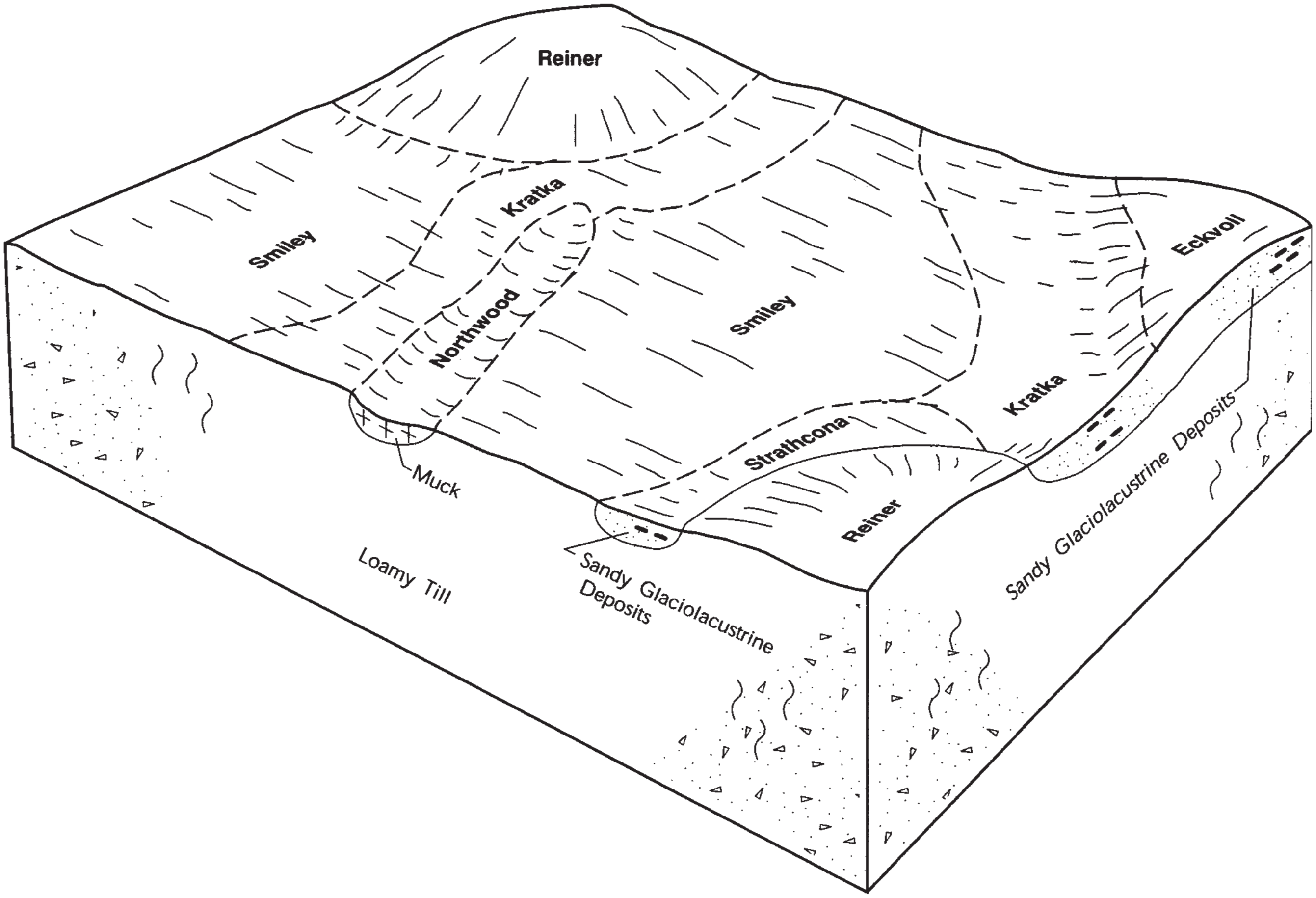
Reiner
Kratka
Smiley
Northwood
Smiley
Eckvoll
Kratka
Strathcona
Reiner
Muck
Loamy Till
Sandy Glaciolacustrine Deposits
Sandy Glaciolacustrine Deposits

Figure 6.—Typical pattern of soils and underlying material in the Smiley-Kratka-Reiner association.

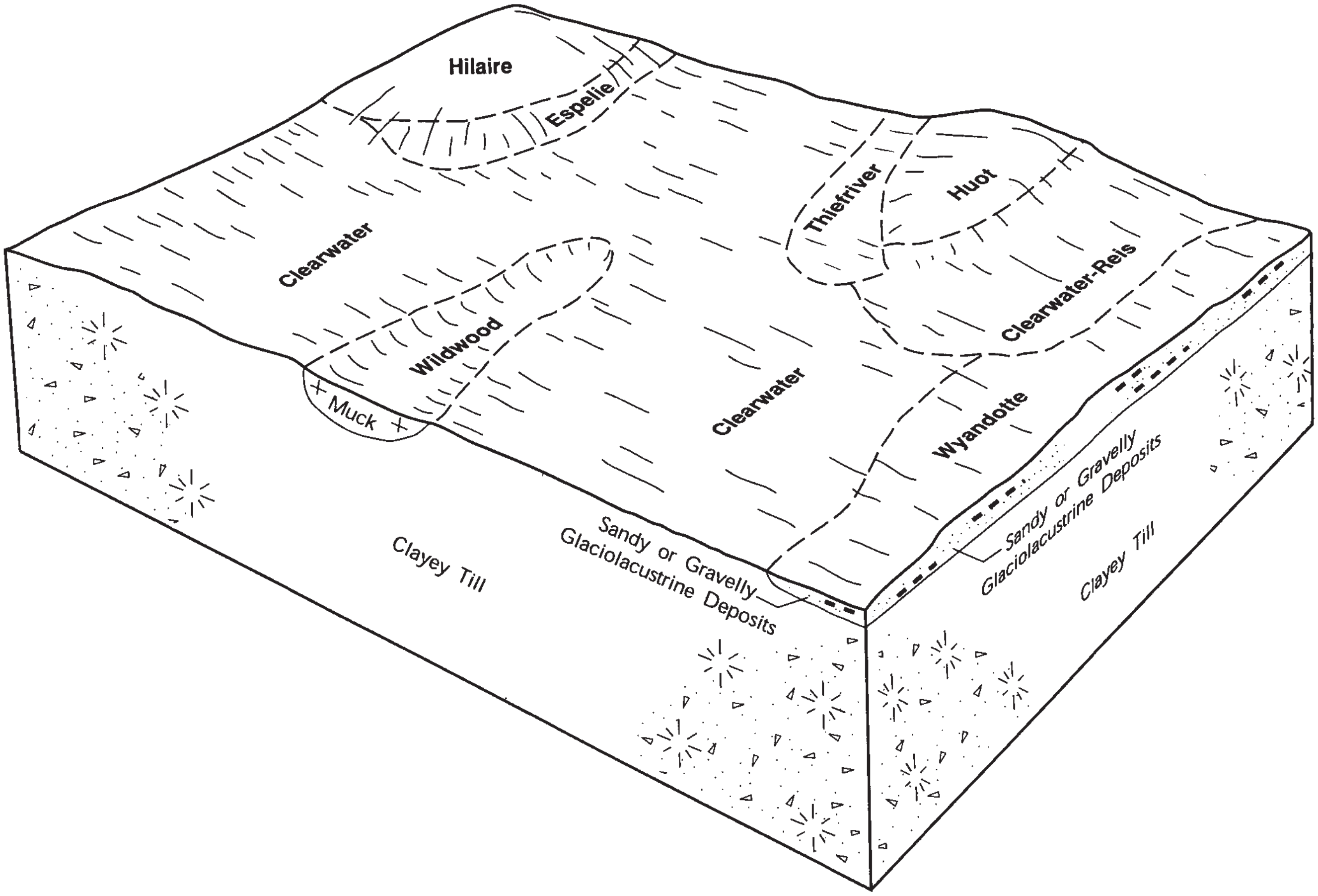
Hilaire
Espelie
Clearwater
Thiefriver
Huot
Clearwater-Reis
Wildwood
Muck
Clearwater
Wyandotte
Sandy or Gravelly Glaciolacustrine Deposits
Clayey Till
Sandy or Gravelly Glaciolacustrine Deposits
Clayey Till

Figure 7.—Typical pattern of soils and underlying material in the Clearwater-Wyandotte association.

Minor Soils

- The very poorly drained Hamre and Northwood soils in depressions
- The poorly drained Roliss and Strandquist soils on flats and in swales
- The poorly drained Strathcona and Vallers soils on flats and slight rises
- The moderately well drained Eckvoll soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture

14. Clearwater-Wyandotte Association

Level and nearly level, poorly drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 2 percent

Composition

Percent of the survey area: 4
Extent of the components in the association (fig. 7):
Clearwater soils: 55 percent
Wyandotte soils: 10 percent
Soils of minor extent: 35 percent

Soil Properties and Qualities

Clearwater

Drainage class: Poorly drained
Position on the landform: Flats and swales
Parent material: Till
Surface texture: Loam, clay

Wyandotte

Drainage class: Poorly drained
Position on the landform: Flats and slight rises
Parent material: Glaciolacustrine deposits and till
Surface texture: Clay loam

Minor Soils

- The very poorly drained Wildwood soils in depressions
- The poorly drained Espelie soils on flats and in swales
- The poorly drained Reis and Thiefriver soils on flats and slight rises
- The moderately well drained Hilaire and Huot soils on slight rises

Use and Management

Major uses: Cropland, forage, and pasture

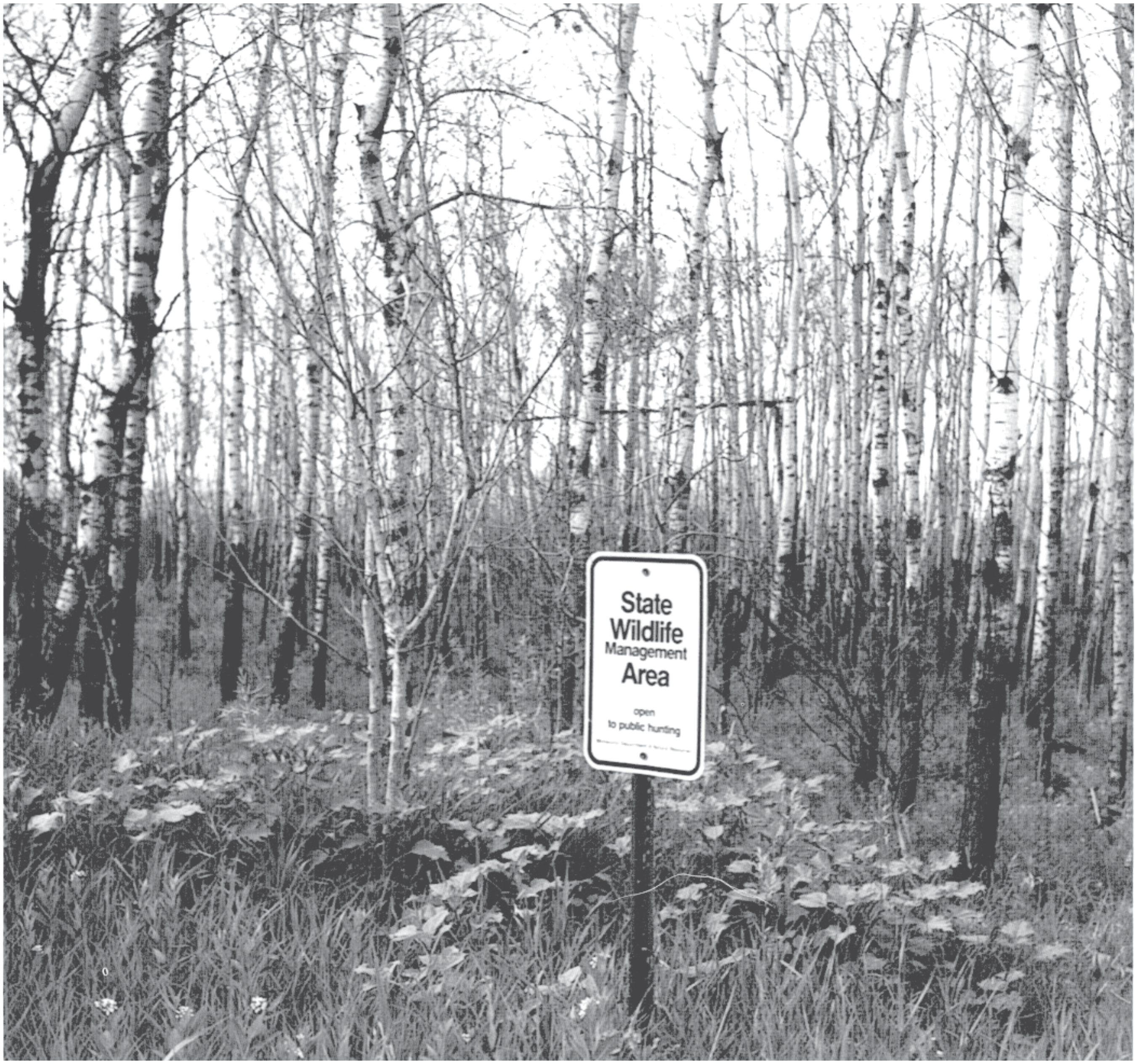

Figure 8.—Many wildlife management areas are in the Cathro-Dora-Wildwood association. These areas provide habitat for deer, moose, gray wolf, and fox.

15. Cathro-Dora-Wildwood Association

Level and nearly level, very poorly drained soils on lake plains

Setting

Landform: Lake plains
Slope range: 0 to 1 percent

Composition

Percent of the survey area: 7
Extent of the components in the association:
Cathro soils: 25 percent
Dora soils: 25 percent
Wildwood soils: 15 percent
Soils of minor extent: 35 percent

Soil Properties and Qualities

Cathro

Drainage class: Very poorly drained
Position on the landform: Depressions
Parent material: Organic materials and glaciolacustrine deposits or till
Surface texture: Muck

Dora

Drainage class: Very poorly drained
Position on the landform: Depressions
Parent material: Organic materials and glaciolacustrine deposits or till
Surface texture: Muck

Wildwood

Drainage class: Very poorly drained
Position on the landform: Depressions
Parent material: Organic materials and glaciolacustrine deposits or till
Surface texture: Muck

Minor Soils

- The very poorly drained Hamre, Haug, Lupton, Markey, Northwood, and Seelyeville soils in depressions
- The poorly drained Clearwater, Roliss, and Smiley soils on flats and in swales

Use and Management

Major use: Wildlife habitat (fig. 8)

Formation and Classification of the Soils

This section relates the soils in the survey area to the major factors of soil formation and describes the system of soil classification.

Formation of the Soils

Soil forms as a result of the action of soil-forming processes on materials deposited or accumulated by geologic activity. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the current climate and the climate under which the soil accumulated; the plant and animal life on and in the soil; the relief or topography and the resulting moisture regime; and the length of time the forces of soil formation have acted on the soil. The factors of soil formation are interdependent and must be considered together when theories regarding the development of a certain soil are formulated.

Climate

Climate affects the physical, chemical, and biological characteristics of the soil. Precipitation, humidity, and frost influence the availability of moisture and the rate of percolation of water through the soil. The movement of water dissolves minerals and transports them in the soil mass. Temperature influences formation by regulating the growth of organisms and the speed of chemical reactions.

Marshall County has a subhumid, continental climate characterized by wide variations in temperature from summer to winter. The winters are long, and the soil is frozen to a depth of 3 to 5 feet for nearly 6 months of the year. During this time the soil-forming processes are largely dormant, except for frost action.

There is slightly more rainfall in the eastern part of the county than in the western part. This difference in the amount of rainfall has produced two types of native vegetation. The soils in the eastern part of Marshall County developed under savannah or forest vegetation, and the soils in the western part formed under prairie vegetation.

Soils that formed in areas of low precipitation in the western part of the survey area have more soluble or colloidal material in the upper part of the profile than other soils, and carbonates at the surface are common. Colvin and Bearden soils are examples. Both of these soils contain a layer of concentrated carbonates in the upper 16 inches. In the soils that formed in areas of higher precipitation in the eastern part of the county, however, most of the carbonates or colloidal clay has been leached from the surface layer and has accumulated below this layer. Smiley, Reiner, and Eckvoll soils are examples of soils that have a layer of clay accumulation. Carbonates are below the accumulated clay.

Living Organisms

All forms of life, both in and on the soil, influence the chemical and biological processes in the soil. Bacteria, earthworms, insects, and other forms of animal life aid in the weathering of materials and the decomposition of organic matter.

Small burrowing animals and larger game animals alter the soil with their droppings and through their browsing of vegetation.

Humans also influence the development of soils by disturbing the natural balance of certain factors and altering related conditions. When natural vegetation is removed and the soil is tilled, erosion is accelerated. Changes in drainage or relief also influence soil development. Cultivation and additions of fertilizer can modify the natural soil-forming processes.

Vegetation and fungi influence soil formation by returning residue to the soil and aiding in decomposition. Plants and plantlike organisms can also influence the transfer of elements within the soil by their influence on soil pH and interaction with other soil-forming factors, such as climate and relief.

The native vegetation in Marshall County can be divided into two types. The western part of the county was once tall grass prairie and wetland reeds and sedges. Some of the prairie vegetation included big bluestem, Canada wildrye, prairie cordgrass, needleandthread, indiangrass, porcupinegrass, and switchgrass. Fire limited some of the tree growth in this area. The soils of the native prairie have a deep, dark surface layer and are rich in organic matter and nutrients. The second type of native vegetation, mixed hardwoods, is in areas east of the Thief River. Bur oak, quaking aspen, and birch are among the hardwood species in this type of vegetation. The surface layer of soils in the forested regions is not as rich in organic matter as that of the prairie soils. Some of the soils that formed under forest vegetation have a lower content of calcium carbonate than the soils that formed under prairie vegetation.

Hardwoods, such as ash, elm, and poplar, are along major stream terraces. These trees aid in stabilizing the soil along the streambanks.

The vegetation on the beach ridges west of the Thief River is a mixture of both prairie and hardwoods. Many of the soils in the county are influenced by this transitional zone and exhibit characteristics of both prairie and forested soils.

Parent Material

The soils of Marshall County formed in three major kinds of parent material. These are calcareous lacustrine deposits in the basin of Glacial Lake Agassiz, calcareous glacial till that was modified and reworked by Lake Agassiz, and alluvial (river) deposits. Glacial Lake Agassiz covered the entire county after the glacier receded. Loamy glacial till underlies all of the present glacial lake sediment at varying depths. The difference in the depth to the glacial till, which is at or near the surface in about two-thirds of the county, accounts for many of the differences in the soils.

The western one-third of the county is a nearly level glacial lake plain. Lacustrine sediment of silt and clay was deposited in lake basins in the western one-fourth of the county. This lacustrine material contains 35 to 75 percent clay and commonly contains less than 5 percent sand. Generally, these soils do not contain rocks or pebbles. Lacustrine sand was deposited on sandbars and deltas and in interbeach areas throughout the rest of this one-third of the county. Most of the soils in this part of the county are poorly drained. Along the eastern border of the glacial lake plain are glacial beach deposits of sand and gravel. Also, sand and gravel ridges scattered throughout the eastern two-thirds of the county are further evidence of the receding shoreline of Glacial Lake Agassiz. The beach deposits and ridges are mostly moderately well drained to excessively drained.

Most of the eastern two-thirds of the county is a nearly level glacial till plain that has been reworked by Glacial Lake Agassiz. This reworking by Lake Agassiz is evidenced by a lag line of stones and gravel at or near the surface. This calcareous till is commonly loam or clay loam. It may contain from 20 to 60 percent sand and at least a small amount of gravel. Most of the soils are poorly drained.

There are several large areas of organic soils in the eastern two-thirds of the county. These soils accumulated from the remains of plants in low areas where there was an abundance of water (Wright, 1972).

A small number of soils were influenced by alluvial action. These soils are adjacent to streams and rivers where the soil was carried, sorted, and redeposited.

Relief

Relief influences soil formation by affecting the relationships among soil temperature, water, erosion, and vegetation. Relief is a minor topographic feature in Marshall County but is an important factor in differentiating soils that formed in similar parent material. In Marshall County it is the micro-relief (slight rises) that distinguishes between some of the soils. For example, Grimstad and Strathcona soils are very similar, but Grimstad soils are on the slight rises and Strathcona soils are in the lower areas. The position of the Grimstad soils on slight rises has an impact on drainage and thus affects the use of these soils for farming, building site development, and engineering uses.

Another example of the effects of micro-relief is in complexes consisting of two poorly drained soils, such as Hegne and Fargo soils. These soils have similar textures, but one of the soils is slightly higher on the landscape than the other. The soil in the higher areas has a higher concentration of carbonates in the upper part than the soil in the lower areas. This concentration of carbonates affects the pH of the soil and the uptake of nutrients.

Because Marshall County has level to gently sloping topography, many of the soils are poorly drained and have a high content of organic matter, have color alterations or mottling, and have a high concentration of carbonates. Soils in the deeper depressions have an organic surface layer and a high water table.

Time

Long periods of time are required for the factors of soil formation to produce a soil profile from the parent material. Much less time is needed for soils to form in warm, humid regions with dense vegetation than in dry, cold regions with little plant life. Drainage also influences how quickly a soil develops. The soils in well drained areas develop more rapidly than those in areas that are less well drained. The nature of the plant material also influences how quickly a soil forms. Glacial till or lacustrine sediment generally develops into a soil much faster than bedrock.

All of the soils in Marshall County are geologically young. Most of the parent material was deposited 9,000 to 12,000 years ago. The parent material was deposited by the most recent glacier and subsequent stages of Glacial Lake Agassiz.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1975). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The table “Classification of the Soils” in Parts I and II of this publication shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Endoaquolls (*Endo*, meaning within, plus *aquoll*, the suborder of the Mollisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Endoaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy, mixed, frigid Typic Endoaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Classification of the Soils

Soil name	Family or higher taxonomic class
Augsburg	Typic Calciaquolls, coarse-silty over clayey, mixed, smectitic, superactive, frigid
Bearden	Aeric Calciaquolls, fine-silty, mixed, superactive, frigid
Berner	Terric Borosaprists, loamy, mixed, euic
Boash	Vertic Epiaquolls, clayey over loamy, smectitic, mixed, superactive, calcareous, frigid
Borup	Typic Calciaquolls, coarse-silty, mixed, superactive, frigid
Cathro	Terric Borosaprists, loamy, mixed, euic
Clearriver	Aquic Udipsamments, mixed, frigid
Clearwater	Typic Epiaquerts, fine, smectitic, frigid
Colvin	Typic Calciaquolls, fine-silty, mixed, superactive, frigid
Corliss	Typic Udipsamments, mixed, frigid
Cormant	Mollic Psammaquents, mixed, frigid
Deerwood	Histic Humaquepts, sandy, mixed, frigid
Dora	Terric Borosaprists, clayey, smectitic, euic
Eaglepoint	Aeric Calciaquerts, very fine, smectitic, frigid
Eckvoll	Aquic Arenic Eutroboralfs, loamy, mixed, superactive
Enstrom	Aquic Udorthents, sandy over loamy, mixed, superactive, nonacid, frigid
Espelie	Typic Epiaquolls, sandy over clayey, mixed, smectitic, frigid
Fargo	Typic Epiaquerts, fine, smectitic, frigid
Flaming	Aquic Haploborolls, sandy, mixed
Fluvaquents	Fluvaquents, loamy
Foldahl	Aquic Haploborolls, sandy over loamy, mixed, superactive
Foxhome	Aquic Haploborolls, sandy-skeletal over loamy, mixed, superactive
Garnes	Aquic Eutroboralfs, fine-loamy, mixed, superactive
Glyndon	Aeric Calciaquolls, coarse-silty, mixed, superactive, frigid
Grimstad	Aeric Calciaquolls, sandy over loamy, mixed, superactive, frigid
Grygla	Mollic Endoaquents, sandy over loamy, mixed, superactive, nonacid, frigid
Hamar	Typic Endoaquolls, sandy, mixed, frigid
Hamerly	Aeric Calciaquolls, fine-loamy, mixed, superactive, frigid
Hamre	Histic Humaquepts, fine-loamy, mixed, superactive, nonacid, frigid
Hangaard	Typic Endoaquolls, sandy, mixed, frigid
Haploborolls	Haploborolls, loamy
Haug	Histic Humaquepts, coarse-loamy, mixed, superactive, calcareous, frigid
Hegne	Typic Calciaquerts, fine, smectitic, frigid
Hilaire	Aquic Haploborolls, sandy over clayey, mixed, smectitic
Huot	Aquic Calciborolls, sandy over clayey, mixed, smectitic
Karlstad	Aquic Eutroboralfs, coarse-loamy, mixed, superactive
Kittson	Aquic Haploborolls, fine-loamy, mixed, superactive
Kratka	Typic Epiaquolls, sandy over loamy, mixed, superactive, frigid
Lamoure	Cumulic Endoaquolls, fine-silty, mixed, superactive, calcareous, frigid
Linveldt	Aquic Argiborolls, coarse-loamy, mixed, superactive
Lupton	Typic Borosaprists, euic
Markey	Terric Borosaprists, sandy or sandy-skeletal, mixed, euic
Marquette	Ochreptic Eutroboralfs, loamy-skeletal, mixed, superactive
Mavie	Typic Calciaquolls, sandy-skeletal over loamy, mixed, superactive, frigid
Nereson	Aquic Argiborolls, coarse-loamy, mixed, superactive
Newfolden	Abruptic Udic Argiborolls, clayey over loamy, smectitic, mixed, superactive
Northcote	Typic Epiaquerts, very fine, smectitic, frigid
Northwood	Histic Humaquepts, sandy over loamy, mixed, superactive, nonacid, frigid
Pelan	Aquic Argiborolls, loamy-skeletal, mixed, superactive
Percy	Typic Calciaquolls, coarse-loamy, mixed, superactive, frigid
Poppleton	Aquic Udipsamments, mixed, frigid
Radium	Aquic Haploborolls, sandy, mixed
Redby	Aquic Udipsamments, mixed, frigid
Reiner	Abruptic Udic Argiborolls, fine-loamy, mixed, superactive
Reis	Typic Calciaquerts, fine, smectitic, frigid
Rifle	Typic Borohemists, euic
Roliss	Typic Endoaquolls, fine-loamy, mixed, superactive, calcareous, frigid
Rosewood	Typic Calciaquolls, sandy, mixed, frigid
Rushlake	Aquic Udipsamments, mixed, frigid
Sahkahtay	Mollic Endoaqualfs, fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid
Sandberg	Udorthentic Haploborolls, sandy, mixed
Seelyeville	Typic Borosaprists, euic

Classification of the Soils--Continued

Soil name	Family or higher taxonomic class
Skagen	Aquic Calciborolls, coarse-loamy, mixed, superactive
Smiley	Typic Argiaquolls, fine-loamy, mixed, superactive, frigid
Strandquist	Typic Endoquolls, sandy-skeletal over loamy, mixed, superactive, calcareous, frigid
Strathcona	Typic Calciaquolls, sandy over loamy, mixed, superactive, frigid
Syrene	Typic Calciaquolls, sandy, mixed, frigid
Tacoosh	Terric Borohemists, loamy, mixed, euic
Thiefriver	Typic Calciaquolls, sandy over clayey, mixed, smectitic, frigid
Udipsamments	Udipsamments
Ulen	Aeric Calciaquolls, sandy, mixed, frigid
Vallers	Typic Calciaquolls, fine-loamy, mixed, superactive, frigid
Wahpeton	Typic Hapluderts, fine, smectitic, frigid
Wheatville	Aeric Calciaquolls, coarse-silty over clayey, mixed, smectitic, superactive, frigid
Wildwood	Histic Humaquepts, very fine, smectitic, nonacid, frigid
Wyandotte	Typic Calciaquolls, sandy-skeletal over clayey, smectitic, frigid

Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
47	Colvin silty clay loam	14,951	1.3
57A	Fargo silty clay, 0 to 2 percent slopes	70,440	6.1
58	Kittson loam	5,576	0.5
59	Grimstad fine sandy loam	46,086	4.0
65	Foxhome sandy loam	6,380	0.5
66	Flaming loamy fine sand	20,883	1.8
67A	Bearden silt loam, 0 to 2 percent slopes	5,355	0.5
67B	Bearden silt loam, 2 to 6 percent slopes	2,201	0.2
77	Garnes fine sandy loam	1,342	0.1
93A	Bearden silty clay loam, 0 to 2 percent slopes	1,609	0.1
111	Hangaard sandy loam	1,423	0.1
116	Redby loamy fine sand	4,196	0.4
117	Cormant loamy fine sand	1,472	0.1
145	Enstrom loamy fine sand	2,331	0.2
148	Poppleton fine sand	7,168	0.6
157A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	10,307	0.9
157B	Wahpeton silty clay, 2 to 6 percent slopes, occasionally flooded	925	*
184A	Hamerly loam, 0 to 3 percent slopes	2,281	0.2
187	Haug muck	6,665	0.6
205	Karlstad loamy sand	6,969	0.6
236	Vallers loam	28,436	2.4
242B	Marquette loamy sand, 1 to 8 percent slopes	2,331	0.2
258B	Sandberg loamy sand, 1 to 6 percent slopes	10,589	0.9
280	Pelan sandy loam	9,452	0.8
372	Hamar loamy fine sand	540	*
379	Percy loam, very cobbly	1,164	0.1
383	Percy loam	11,958	1.0
384	Percy mucky loam, depressional	785	*
387	Roliss loam, depressional	2,504	0.2
412	Mavie fine sandy loam	31,967	2.8
418	Lamoure silty clay loam, occasionally flooded	1,749	0.2
426	Foldahl loamy fine sand	13,202	1.1
429A	Northcote clay, 0 to 2 percent slopes	23,470	2.0
432	Strandquist loam	10,236	0.9
435	Syrene sandy loam	9,572	0.8
439	Strathcona fine sandy loam	45,792	3.9
481	Kratka fine sandy loam	37,461	3.2
482	Grygla loamy fine sand	2,652	0.2
514	Tacoosh muck	2,410	0.2
540	Seelyeville muck	6,331	0.5
541	Rifle mucky peat	7,818	0.7
543	Markey muck	10,118	0.9
544	Cathro muck	11,884	1.0
546	Lupton muck	2,503	0.2
547	Deerwood muck	7,387	0.6
550	Dora muck	10,543	0.9
563	Northwood muck	28,967	2.5
565	Eckvoll loamy fine sand	9,208	0.8
582	Roliss loam	28,970	2.5
583	Nereson fine sandy loam	2,626	0.2
630	Wildwood muck	4,800	0.4
641	Clearwater clay	8,726	0.8
642	Clearwater loam	20,639	1.8
643	Huot fine sandy loam	10,479	0.9
644	Boash clay loam	3,583	0.3
645	Espelie fine sandy loam	4,653	0.4
647	Hilaire loamy fine sand	3,311	0.3
648	Newfolden loam	1,161	0.1
649	Reiner loamy fine sand	3,133	0.3
650	Reiner fine sandy loam	16,916	1.4
651	Thiefriver fine sandy loam	3,271	0.3
652	Wyandotte clay loam	5,651	0.5

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
653	Smiley mucky loam, depressional	4,023	0.3
708	Rushlake loamy sand	1,929	0.2
712	Rosewood fine sandy loam	16,264	1.4
713	Linveldt fine sandy loam	2,528	0.2
721B	Corliss loamy sand, 1 to 6 percent slopes	2,188	0.2
765	Smiley loam	68,137	5.9
794	Clearriver loamy fine sand	4,076	0.4
935	Hegne-Fargo complex	51,548	4.4
936	Clearwater-Reis complex	2,646	0.2
937	Eaglepoint-Northcote complex	15,927	1.4
972	Roliss-Vallers complex	33,450	2.9
1006	Fluvaquents-Haploborolls complex, 0 to 30 percent slopes, flooded	10,864	0.9
1030	Pits, gravel-Udipsamments complex	2,996	0.2
1031	Seelyeville muck, ponded	1,071	*
1143	Berner-Markey complex	1,525	0.1
1144	Strathcona and Kratka soils, depressional	4,595	0.4
1146	Northwood muck, ponded	785	*
1158	Skagen loam	711	*
1170	Skagen loam, very cobbly	797	*
1187	Dora muck, ponded	8,685	0.7
1188	Wildwood muck, ponded	7,271	0.6
1189	Clearwater mucky loam, depressional	2,664	0.2
1191	Sahkahtay sandy loam	897	*
1264	Ulen loamy fine sand	44,686	3.8
1297	Augsburg very fine sandy loam	1,784	0.2
1299	Borup very fine sandy loam	3,418	0.3
1304A	Glyndon very fine sandy loam, 0 to 2 percent slopes	15,828	1.4
1304B	Glyndon very fine sandy loam, 2 to 6 percent slopes	559	*
1315A	Wheatville very fine sandy loam, 0 to 2 percent slopes	23,707	2.0
1804	Hamre muck, ponded	8,950	0.8
1807	Cathro muck, ponded	7,985	0.7
1808	Markey muck, ponded	1,140	*
1871	Fargo silty clay, swales	635	*
1874	Radium loamy sand	4,904	0.4
1878	Hamre muck	13,776	1.2
1882	Rosewood, Strathcona, and Berner soils, seepy	476	*
1963	Bearden-Colvin complex	24,486	2.1
1964	Colvin-Fargo complex	50,560	4.4
1966	Rosewood-Hamar complex	321	*
	Water	33,800	2.9
	Total	1,160,100	100.0

* Less than 0.1 percent.

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Soil Series and Detailed Soil Map Units

In this section, arranged in alphabetical order, each soil series recognized in the survey area is described. Each description is followed by the detailed soil map units associated with the series.

Characteristics of the soil and the material in which it formed are identified for each soil series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given in Part II of this survey.

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit. The principal hazards and limitations to be considered in planning for specific uses are described in Part II of this survey.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer or of the underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Fargo silty clay, 0 to 2 percent slopes, is a phase of the Fargo series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Hegne-Fargo complex is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Strathcona and Kratka soils, depressional, is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. The Pits component of the Pits, gravel-Udipsamments complex is an example.

The table "Acreage and Proportionate Extent of the Soils" in Parts I and II of this survey gives the acreage and proportionate extent of each map unit. Other tables (see Contents) give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

Augsburg Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—moderately rapid; lower part—slow or very slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Coarse-silty over clayey, mixed over smectitic, superactive, frigid Typic Calciaquolls

Typical Pedon

Augsburg very fine sandy loam, 250 feet south and 1,100 feet east of the northwest corner of sec. 30, T. 155 N., R. 47 W.

Ap—0 to 9 inches; black (10YR 2/1) very fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few very fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—9 to 16 inches; grayish brown (2.5Y 5/2) loamy very fine sand; common fine and medium distinct light olive brown (2.5Y 5/6) iron concentrations; weak fine subangular blocky structure; very friable; few very fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg2—16 to 29 inches; light brownish gray (2.5Y 6/2) loamy very fine sand; common medium distinct light olive brown (2.5Y 5/6) and many medium distinct light yellowish brown (2.5Y 6/4) iron concentrations; weak fine subangular blocky structure; very friable; few very fine roots; few soft masses of carbonates; strongly effervescent; moderately alkaline; abrupt wavy boundary.

2Bg—29 to 60 inches; olive gray (5Y 4/2) clay; many fine and medium faint dark olive gray (5Y 3/2) iron depletions and common fine faint olive (5Y 4/3) iron concentrations; weak very fine angular blocky structure; firm; few fine threads of carbonate; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 13 inches
Thickness of the surface mantle: 20 to 40 inches

A horizon:
Hue—10YR
Value—2
Chroma—1
Texture—very fine sandy loam

Bkg horizon:
Hue—2.5Y
Value—5 or 6
Chroma—1 or 2
Texture—loamy very fine sand, very fine sandy loam, or silt loam

2Bg horizon:
Hue—2.5Y or 5Y
Value—3 or 4
Chroma—1 or 2
Texture—clay

1297—Augsburg very fine sandy loam

Composition

Augsburg and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Very fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Wheatville and similar soils
- Borup and similar soils
- Glyndon and similar soils
- Thiefriver and similar soils
- Fargo and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Bearden Series

Depth class: Very deep
Drainage class: Somewhat poorly drained or moderately well drained
Permeability: Moderate or moderately slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 6 percent
Taxonomic classification: Fine-silty, mixed, superactive, frigid Aeric Calciaquolls

Typical Pedon

Bearden silt loam, 0 to 2 percent slopes, 300 feet north and 500 feet east of the southwest corner of sec. 28, T. 155 N., R. 49 W.

Ap—0 to 9 inches; black (N 2/0) silt loam, black (10YR 2/1) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 16 inches; grayish brown (10YR 5/2) silt loam; weak medium subangular blocky structure; friable; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—16 to 24 inches; light olive brown (2.5Y 5/4) silt loam; many medium distinct olive gray (5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; disseminated carbonates; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bw—24 to 29 inches; light olive brown (2.5Y 5/4) silt loam; common fine prominent dark yellowish brown (10YR 4/6) iron concentrations and common fine distinct grayish brown (2.5Y 5/2) iron depletions; weak medium subangular blocky structure; friable; few soft masses of carbonates; few fine very dark brown (10YR 2/2) manganese concretions; slightly effervescent; slightly alkaline; gradual wavy boundary.

C—29 to 60 inches; light olive brown (2.5Y 5/4) silt loam; many fine prominent dark yellowish brown (10YR 4/6) and many fine and medium distinct olive yellow (2.5Y 6/6) iron concentrations and many fine and medium faint olive gray (5Y 4/2) and light olive gray (5Y 6/2) iron depletions; massive with weak medium platy and subangular blocky soil fragments; friable; common medium very dark brown (10YR 2/2) manganese coatings on faces of peds; common medium soft masses of carbonates; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 19 inches

A horizon:
Hue—neutral, 10YR, 2.5Y, or 5Y
Value—2 or 3
Chroma—0 or 1
Texture—silt loam or silty clay loam

Bk horizon:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 6

Chroma—1 to 4
Texture—silt loam or silty clay loam

Bw horizon:
Hue—2.5Y
Value—5
Chroma—4
Texture—silty clay loam or silt loam

C horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—2 to 4
Texture—silty clay loam or silt loam

67A—Bearden silt loam, 0 to 2 percent slopes

Composition

Bearden and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Colvin and similar soils
- Fargo and similar soils
- Glyndon and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

67B—Bearden silt loam, 2 to 6 percent slopes

Composition

Bearden and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Lake plains
Position on the landform: Backslopes
Slope: 2 to 6 percent

Component Description

Surface layer texture: Silt loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Colvin and similar soils
- Fargo and similar soils
- Glyndon and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

93A—Bearden silty clay loam, 0 to 2 percent slopes

Composition

Bearden and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Colvin and similar soils
- Fargo and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1963—Bearden-Colvin complex

Composition

Bearden and similar soils: About 50 percent
Colvin and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Bearden—flats and slight rises on lake plains; Colvin—swales on lake plains
Slope: 0 to 2 percent

Component Description

Bearden

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.5 inches
Organic matter content: High

Colvin

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Fargo and similar soils
- Hegne and similar soils
- Glyndon and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Berner Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderately slow to moderately rapid; next part—rapid; lower part—moderate or moderately slow
Landform: Lake plains
Parent material: Organic materials and glaciolacustrine deposits or till
Slope range: 0 to 1 percent
Taxonomic classification: Loamy, mixed, euic Terric Borosaprists

Typical Pedon

Berner muck, in an area of Berner-Markey complex, 2,600 feet north and 400 feet west of the southeast corner of sec. 6, T. 154 N., R. 44 W.

Oa1—0 to 7 inches; dark brown (7.5YR 3/2) muck; 40 percent fiber, 10 percent rubbed; weak thin platy structure; very friable; common fine roots; moderately acid; clear smooth boundary.
Oa2—7 to 18 inches; dark brown (7.5YR 3/2) muck;

40 percent fiber, 10 percent rubbed; weak thick platy structure parting to weak thin platy; very friable; few fine roots; slightly acid; abrupt smooth boundary.

Oa3—18 to 29 inches; black (10YR 2/1) muck; 10 percent fiber, trace of fiber rubbed; massive; very friable; moderately acid; clear smooth boundary.

Oa4—29 to 33 inches; black (N 2/0) muck; 5 percent fiber, trace of fiber rubbed; massive; very friable; slightly acid; abrupt smooth boundary.

Cg1—33 to 44 inches; light brownish gray (2.5Y 6/2) gravelly sand; single grain; loose; 15 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

2Cg2—44 to 60 inches; gray (5Y 5/1) clay loam; massive with fine and medium blocky soil fragments; friable; many soft masses of carbonates; 5 percent gravel; moderately alkaline.

Range in Characteristics

Depth to carbonates: 21 to 51 inches
Thickness of the histic epipedon: 16 to 34 inches
Depth to glacial till: 30 to 45 inches
Other features: An A horizon in some pedons

Oa horizon:
Hue—10YR, 7.5YR, or neutral
Value—2 to 4
Chroma—0 to 3
Texture—muck

A horizon (if it occurs):
Hue—neutral
Value—2
Chroma—0
Texture—fine sandy loam or loamy sand

Cg horizon:
Hue—2.5Y
Value—4 to 6
Chroma—1 or 2
Texture—gravelly sand, sand, gravelly coarse sand, coarse sand, or fine sand
Content of rock fragments—5 to 20 percent

2Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—clay loam, loam, fine sandy loam, or sandy loam
Content of rock fragments—3 to 10 percent

1143—Berner-Markey complex

Composition

Berner and similar soils: About 55 percent
Markey and similar soils: About 30 percent
Inclusions: About 15 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Berner

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 17.4 inches
Organic matter content: Very high

Markey

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 13.3 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Seelyeville and similar soils
- Northwood and similar soils
- Deerwood and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Boash Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—slow; lower part—moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Clayey over loamy, calcareous, smectitic over loamy, mixed, superactive, frigid Vertic Epiaquolls

Typical Pedon

Boash clay loam, 2,100 feet south and 800 feet east of the northwest corner of sec. 20, T. 155 N., R. 42 W.

Ap—0 to 7 inches; black (N 2/0) clay loam, very dark gray (N 3/0) dry; weak medium subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

Bg1—7 to 22 inches; olive gray (5Y 4/2) silty clay; few fine prominent dark yellowish brown (10YR 4/6) iron concentrations; moderate medium subangular blocky structure; firm; few fine threads of carbonate; 2 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

Bg2—22 to 33 inches; dark gray (5Y 4/1) silty clay; few fine prominent dark yellowish brown (10YR 4/6) iron concentrations; moderate fine subangular blocky structure; firm; few fine threads of carbonate; 2 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

2Bkg—33 to 60 inches; grayish brown (2.5Y 5/2) loam; few medium prominent olive yellow (2.5Y 6/6) iron concentrations; weak fine subangular blocky structure; friable; common fine threads of carbonate; 3 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: Less than 10 inches
Thickness of the mollic epipedon: 7 to 20 inches
Thickness of the clayey mantle: 15 to 38 inches

A horizon:
Hue—neutral or 10YR
Value—2
Chroma—0 or 1
Texture—clay loam

Bg horizon:
Hue—2.5Y or 5Y
Value—3 to 5
Chroma—1 or 2
Texture—silty clay, silty clay loam, or clay
Content of rock fragments—2 to 5 percent

2Bkg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—loam or clay loam
Content of rock fragments—3 to 8 percent

644—Boash clay loam

Composition

Boash and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Clearwater and similar soils
- Hamerly and similar soils
- Kratka and similar soils
- Newfolden and similar soils
- Vallers and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Borup Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Coarse-silty, mixed, superactive, frigid Typic Calciaquolls

Typical Pedon

Borup very fine sandy loam, 1,750 feet north and 700 feet west of the southeast corner of sec. 29, T. 158 N., R. 47 W.

Ap—0 to 8 inches; black (N 2/0) very fine sandy loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure; very friable; few very fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—8 to 14 inches; dark grayish brown (2.5Y 4/2) very fine sandy loam; few fine distinct yellowish brown (10YR 5/4) iron concentrations; weak very fine subangular blocky structure; very friable; few very fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.

Bkg2—14 to 21 inches; grayish brown (2.5Y 5/2) loamy very fine sand; common fine prominent yellowish brown (10YR 5/6) iron concentrations; weak very fine subangular blocky structure; very friable; few very fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.

Bkg3—21 to 26 inches; light brownish gray (2.5Y 6/2) silt loam; common fine distinct olive yellow (2.5Y 6/6) iron concentrations; weak fine subangular blocky structure; friable; few very fine roots; many medium carbonate coatings on faces of peds and in pores; strongly effervescent; slightly alkaline; clear smooth boundary.

Bkg4—26 to 36 inches; dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) silt loam; common fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak fine subangular blocky structure; friable; common fine carbonate coatings on faces of peds and in pores; strongly effervescent; slightly alkaline; clear wavy boundary.

Cg—36 to 60 inches; grayish brown (2.5Y 5/2), stratified silt loam and very fine sand; common fine distinct light olive brown (2.5Y 5/6) and common fine prominent dark brown (7.5YR 4/4) iron concentrations; weak medium platy soil fragments; friable; common fine carbonate coatings on faces of peds and in pores; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 15 inches

A horizon:
Hue—neutral or 10YR
Value—2
Chroma—0 or 1
Texture—very fine sandy loam

Bkg horizon:
Hue—2.5Y or 10YR
Value—4 to 6
Chroma—2
Texture—very fine sandy loam, loamy very fine sand, or silt loam

Cg horizon:
Hue—2.5Y
Value—4 to 6
Chroma—2 or 3
Texture—silt loam, very fine sandy loam, loam, or very fine sand

1299—Borup very fine sandy loam

Composition

Borup and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Very fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None

Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Glyndon and similar soils
- Augsburg and similar soils
- Rosewood and similar soils
- Colvin and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Cathro Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderately slow to moderately rapid; lower part—moderate or moderately slow
Landform: Lake plains
Parent material: Organic materials and till
Slope range: 0 to 1 percent
Taxonomic classification: Loamy, mixed, euic Terric Borosaprists

Typical Pedon

Cathro muck, 2,400 feet north and 2,400 feet west of the southeast corner of sec. 23, T. 157 N., R. 43 W.

Oa1—0 to 11 inches; black (10YR 2/1) muck; 30 percent fiber, 10 percent rubbed; weak fine granular structure; friable; many fine and medium roots; strongly acid; clear wavy boundary.

Oa2—11 to 25 inches; black (N 2/0) muck; 15 percent fiber, 5 percent rubbed; weak thin platy structure; friable; common fine roots; strongly acid; clear smooth boundary.

A—25 to 28 inches; black (N 2/0) mucky fine sandy loam; weak fine subangular blocky structure; friable; few fine roots; 2 percent gravel; neutral; abrupt wavy boundary.

Cg—28 to 60 inches; olive gray (5Y 5/2) fine sandy loam; common medium prominent light olive brown (2.5Y 5/6) iron concentrations and common fine faint light brownish gray (2.5Y 6/2) iron depletions; massive with medium blocky soil fragments; friable; few fine roots; common fine threads of carbonate; 7 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 16 to 42 inches
Thickness of the histic epipedon: 16 to 40 inches

Oa horizon:
Hue—neutral, 7.5YR, or 10YR
Value—2 or 3
Chroma—0 to 2
Texture—muck

A horizon:
Hue—neutral, 2.5Y, or 10YR
Value—2 to 4
Chroma—0 or 1
Texture—mucky fine sandy loam, mucky loam, clay loam, fine sandy loam, sandy loam, or loam
Content of rock fragments—2 to 4 percent

Cg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 to 3
Texture—fine sandy loam, sandy loam, loam, or clay loam
Content of rock fragments—2 to 8 percent

544—Cathro muck

Composition

Cathro and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface

Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 16.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Hamre and similar soils
- Seelyeville and similar soils
- Soils that are ponded

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1807—Cathro muck, ponded

Composition

Cathro and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and till
Flooding: None
Seasonal high water table: 3.0 feet above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 20.4 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Berner and similar soils
- Hamre and similar soils
- Seelyeville and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Clearriver Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Beach ridges on lake plains
Parent material: Beach deposits
Slope range: 0 to 3 percent
Taxonomic classification: Mixed, frigid Aquic Udipsamments

Typical Pedon

Clearriver loamy fine sand, 200 feet south and 200 feet east of the northwest corner of sec. 7, T. 157 N., R. 43 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) loamy fine sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.
E/Bt—9 to 14 inches; mixed, dark grayish brown (10YR 4/2) fine sand and dark brown (10YR 3/3) sandy clay loam; common medium distinct strong brown (7.5YR 4/6) iron concentrations; moderate fine and medium subangular blocky structure; friable; clay bridging between sand grains; 7 percent gravel; neutral; clear smooth boundary.
C1—14 to 25 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; 12 percent gravel; slightly effervescent; neutral; gradual wavy boundary.
C2—25 to 44 inches; light brownish gray (2.5Y 6/2) gravelly coarse sand; few common distinct light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; 21 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.
C3—44 to 60 inches; light brownish gray (2.5Y 6/2) sand; few common distinct light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; 4

percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 14 to 30 inches
Thickness of the surface layer: 3 to 10 inches

A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—loamy fine sand

E part of the E/Bt horizon:
Hue—10YR
Value—3 or 4
Chroma—2 to 4
Texture—fine sand or sand
Content of rock fragments—2 to 7 percent

Bt part of the E/Bt horizon:
Hue—7.5YR or 10YR
Value—3 or 4
Chroma—3 or 4
Texture—sandy loam, coarse sandy loam, sandy clay loam, or loamy sand
Content of rock fragments—5 to 7 percent

C horizon:
Hue—2.5Y or 10YR
Value—4 to 6
Chroma—2 to 4
Texture—fine sand, sand, coarse sand, or gravelly coarse sand
Content of rock fragments—4 to 30 percent

794—Clearriver loamy fine sand

Composition

Clearriver and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on beach plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: 2.0 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 3.3 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Grygla and similar soils
- Corliss and similar soils
- Cormant and similar soils
- Northwood and similar soils
- Sahkahtay and similar soils
- Redby and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Clearwater Series

Depth class: Very deep
Drainage class: Poorly drained or very poorly drained
Permeability: Upper part—moderate to slow; lower part—slow
Landform: Lake plains
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Fine, smectitic, frigid Typic Epiaquerts

Typical Pedon

Clearwater loam, 275 feet south and 2,350 feet west of the northeast corner of sec. 31, T. 156 N., R. 42 W.

Ap—0 to 8 inches; black (N 2/0) loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to moderate very fine granular; friable; few fine roots; 4 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Bssg1—8 to 20 inches; dark grayish brown (2.5Y 4/2) silty clay; many fine distinct light olive brown (2.5Y 5/6) iron concentrations and many fine distinct dark gray (5Y 4/1) iron depletions; moderate fine angular blocky structure; firm; few fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 45 degrees above the horizontal; cracks 1/4 inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; 4 percent gravel; strongly effervescent; slightly alkaline; gradual smooth boundary.

Bssg2—20 to 33 inches; dark grayish brown (2.5Y 4/2) clay; many fine distinct light olive brown (2.5Y 5/6) iron concentrations and many fine faint olive gray (5Y 4/2) iron depletions; moderate fine angular blocky structure; firm; common fine threads of carbonate; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; 5 percent gravel; strongly effervescent; slightly alkaline; gradual smooth boundary.

Bg—33 to 60 inches; olive gray (5Y 4/2) clay; many fine and medium faint dark olive gray (5Y 3/2) and very dark gray (5Y 3/1) iron depletions and common fine and medium prominent light olive brown (2.5Y 5/6) iron concentrations; moderate fine angular blocky structure; very firm; common fine threads of carbonate; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches
Depth to carbonates: Less than 10 inches

A horizon:
Hue—neutral, 10YR, or 2.5Y
Value—2 or 3
Chroma—0 or 1
Texture—clay, loam, or mucky loam
Content of rock fragments—1 to 4 percent

Bssg and Bg horizons:
Hue—2.5Y or 5Y
Value—3 to 5
Chroma—1 or 2
Texture—silty clay, clay, or silty clay loam
Content of rock fragments—3 to 8 percent

641—Clearwater clay

Composition

Clearwater and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.8 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Augsburg and similar soils
- Thiefriver and similar soils
- Newfolden and similar soils
- Wyandotte and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

642—Clearwater loam

Composition

Clearwater and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.6 inches

Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Wyandotte and similar soils
- Augsburg and similar soils
- Newfolden and simialr soils
- Thiefriver and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

936—Clearwater-Reis complex

Composition

Clearwater and similar soils: About 50 percent
Reis and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Clearwater—flats and swales on lake plains; Reis—slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Clearwater

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.6 inches
Organic matter content: Moderate

Reis

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Wheatville and similar soils
- Glyndon and similar soils
- Augsburg and similar soils
- Newfolden and similar soils
- Espelie and similar soils
- Wyandotte and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1189—Clearwater mucky loam, depressional

Composition

Clearwater and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Mucky loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 9.6 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Espelie and similar soils
- Wildwood and similar soils
- Reis and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Colvin Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Fine-silty, mixed, superactive, frigid Typic Calciaquolls

Typical Pedon

Colvin silty clay loam, 450 feet south and 1,050 feet east of the northwest corner of sec. 25, T. 156 N., R. 49 W.

Ap—0 to 9 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; few very fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—9 to 14 inches; very dark gray (5Y 3/1) silty clay loam; weak medium subangular blocky structure; friable; few very fine roots; disseminated carbonates; violently effervescent; moderately alkaline; gradual wavy boundary.

Bkg2—14 to 29 inches; olive gray (5Y 4/2) silty clay loam; few fine prominent olive yellow (2.5Y 6/6) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg3—29 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations; weak fine subangular blocky structure; friable; few fine roots; common fine threads of carbonate on faces of peds and in pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Cg—40 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations; massive with medium blocky and platy soil fragments; friable; common threads of carbonate on faces of peds and in pores; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam

Bkg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 6
Chroma—1 or 2
Texture—silt loam or silty clay loam

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2
Texture—silt loam or silty clay loam

47—Colvin silty clay loam

Composition

Colvin and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Bearden and similar soils
- Fargo and similar soils
- Augsburg and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1964—Colvin-Fargo complex

Composition

Colvin and similar soils: About 50 percent
Fargo and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Colvin—flats and slight rises on lake plains; Fargo—swales on lake plains
Slope: 0 to 2 percent

Component Description

Colvin

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches
Organic matter content: High

Fargo

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Seasonal high water table: At the surface to 1.5 feet below the surface
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Bearden and similar soils
- Hegne and similar soils
- Northcote and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Corliss Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid or very rapid
Landform: Beach ridges on lake plains
Parent material: Beach deposits
Slope range: 1 to 6 percent
Taxonomic classification: Mixed, frigid Typic Udipsamments

Typical Pedon

Corliss loamy sand, 1 to 6 percent slopes, 2,200 feet north and 2,400 feet east of the southwest corner of sec. 11, T. 158 N., R. 40 W.

Ap—0 to 7 inches; black (10YR 2/1) loamy sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; 1 percent gravel; slightly acid; abrupt smooth boundary.
Bw—7 to 12 inches; brown (10YR 4/3) gravelly sand; single grain; loose; 15 percent gravel; 1 percent cobbles; neutral; clear smooth boundary.
C1—12 to 34 inches; dark grayish brown (10YR 4/2) gravelly sand; single grain; loose; 15 percent gravel; 2 percent cobbles; slightly effervescent; slightly alkaline; clear wavy boundary.
C2—34 to 50 inches; grayish brown (10YR 5/2) sand; single grain; loose; 12 percent gravel; 2 percent cobbles; slightly effervescent; slightly alkaline; gradual wavy boundary.
C3—50 to 60 inches; grayish brown (10YR 5/2) gravelly sand; single grain; loose; 20 percent gravel; 3 percent cobbles; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 12 to 40 inches
Content of rock fragments: 10 to 35 percent

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand
Content of rock fragments—less than 2 percent

Bw horizon:
Hue—10YR
Value—4
Chroma—3 or 4
Texture—coarse sand, sand, loamy coarse sand, loamy sand, gravelly sand, or gravelly coarse sand
Content of rock fragments—2 to 20 percent gravel

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—gravelly coarse sand, gravelly sand, coarse sand, sand, or fine sand
Content of rock fragments—2 to 35 percent

721B—Corliss loamy sand, 1 to 6 percent slopes

Composition

Corliss and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Beach ridges
Position on the landform: Summits and backslopes
Slope: 1 to 6 percent

Component Description

Surface layer texture: Loamy sand
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Sahkahtay and similar soils
- Syrene and similar soils
- Marquette and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Cormant Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Mixed, frigid Mollic Psammaquents

Typical Pedon

Cormant loamy fine sand, 400 feet north and 600 feet west of the southeast corner of sec. 12, T. 158 N., R. 39 W.

A—0 to 8 inches; black (10YR 2/1) loamy fine sand, gray (10YR 5/1) dry; weak very fine subangular blocky structure; very friable; few very fine roots; neutral; abrupt smooth boundary.

Cg1—8 to 14 inches; grayish brown (2.5Y 5/2) fine sand; few fine prominent brownish yellow (10YR 6/6) iron concentrations; single grain; loose; few fine roots; neutral; gradual smooth boundary.

Cg2—14 to 34 inches; grayish brown (2.5Y 5/2) fine sand; common medium prominent yellowish brown (10YR 5/6) and few fine prominent dark yellowish brown (10YR 4/6) iron concentrations; single grain; loose; few fine roots; neutral; gradual smooth boundary.

Cg3—34 to 54 inches; light brownish gray (2.5Y 6/2) fine sand; common medium prominent yellowish brown (10YR 5/6) and few fine prominent dark yellowish brown (10YR 4/6) iron concentrations; single grain; loose; neutral; abrupt wavy boundary.

Cg4—54 to 60 inches; light olive gray (5Y 6/2) fine sand; few fine distinct light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: More than 40 inches
Thickness of the surface layer: 5 to 9 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—loamy fine sand

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2
Texture—fine sand or sand

117—Cormant loamy fine sand

Composition

Cormant and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 5.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Redby and similar soils
- Grygla and similar soils
- Deerwood and similar soils
- Eckvoll and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Deerwood Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderate or moderately rapid; lower part—rapid
Landform: Lake plains
Parent material: Organic materials and glaciolacustrine deposits
Slope range: 0 to 1 percent
Taxonomic classification: Sandy, mixed, frigid Histic Humaquepts

Typical Pedon

Deerwood muck, 100 feet south and 100 feet west of the northeast corner of sec. 28, T. 157 N., R. 43 W.

Oa—0 to 11 inches; black (N 2/0) muck; 25 percent fiber, 10 percent rubbed; moderate fine granular structure; very friable; many very fine roots; neutral; abrupt smooth boundary.
A—11 to 15 inches; black (N 2/0) fine sandy loam; massive; friable; few fine roots; few thin sand lenses; 1 percent gravel; slightly effervescent; neutral; clear smooth boundary.
Cg—15 to 60 inches; light gray (2.5Y 7/2) fine sand; common fine faint light brownish gray (2.5Y 6/2) iron depletions and few fine distinct light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; 10 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Less than 16 inches
Thickness of the histic epipedon: 8 to 16 inches

Oa horizon:
Hue—10YR or neutral
Value—2
Chroma—0 or 1
Texture—muck

A horizon:
Hue—5Y or neutral

Value—2 or 3
Chroma—0 or 1
Texture—fine sandy loam, loamy fine sand, or loamy sand
Content of rock fragments—1 to 5 percent

Cg horizon:
Hue—2.5Y or 5Y
Value—5 to 7
Chroma—1 or 2
Texture—fine sand, sand, or gravelly coarse sand
Content of rock fragments—2 to 35 percent

547—Deerwood muck

Composition

Deerwood and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 6.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hangaard and similar soils
- Rosewood and similar soils
- Northwood and similar soils
- Markey and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Dora Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderate or moderately rapid; lower part—very slow
Landform: Lake plains
Parent material: Organic materials and glaciolacustrine deposits or till
Slope range: 0 to 1 percent
Taxonomic classification: Clayey, smectitic, euic Terric Borosaprists

Typical Pedon

Dora muck, 600 feet south and 1,500 feet east of the northwest corner of sec. 12, T. 155 N., R. 42 W.

Oa1—0 to 23 inches; black (10YR 2/1) muck; 35 percent fiber, 5 percent rubbed; weak thin platy structure; very friable; many very fine and common fine and medium roots; strongly acid; gradual smooth boundary.

Oa2—23 to 31 inches; black (N 2/0) muck; 15 percent fiber, trace rubbed; weak thin platy structure; very friable; moderately acid; abrupt smooth boundary.

Cg1—31 to 36 inches; dark grayish brown (2.5Y 4/2) clay; common medium prominent strong brown (7.5YR 4/6) iron concentrations; massive with medium blocky soil fragments; firm; 2 percent gravel; slightly effervescent; neutral; abrupt wavy boundary.

Cg2—36 to 60 inches; light brownish gray (2.5Y 6/2) silty clay; common medium prominent strong brown (7.5YR 4/6) iron concentrations; massive with fine and medium blocky soil fragments; firm; many threads of carbonate; 2 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to 42 inches
Thickness of the histic epipedon: 18 to 38 inches

Oa horizon:
Hue—7.5YR, 10YR, or neutral
Value—2
Chroma—0 or 1
Texture—muck

Cg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6

Chroma—1 or 2
Texture—clay, silty clay, or silty clay loam
Content of rock fragments—1 to 5 percent

550—Dora muck

Composition

Dora and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Depth to the water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 18.3 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Wildwood and similar soils
- Soils that are ponded
- Seelyeville and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1187—Dora muck, ponded

Composition

Dora and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits
Flooding: None
Seasonal high water table: At the surface to 2 feet above the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 16.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Wildwood and similar soils
- Seelyeville and similar soils
- Soils that have a mineral surface layer

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Eaglepoint Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Slow or very slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Very fine, smectitic, frigid Aeric Calciaquerts

Typical Pedon

Eaglepoint clay, in an area of Eaglepoint-Northcote complex, 1,684 feet north and 400 feet west of the southeast corner of sec. 3, T. 157 N., R. 49 W.

Ap—0 to 10 inches; black (5Y 2.5/1) clay, very dark gray (5Y 3/1) dry; strong coarse and medium subangular blocky structure; very firm; many very fine roots; few fine and medium calcium carbonate threads and concretions on faces of peds; strongly effervescent; slightly alkaline; clear wavy boundary.

Bkss1—10 to 22 inches; olive gray (5Y 5/2) clay; moderate thin platy structure parting to strong very fine angular blocky; very firm; common very fine roots in peds and pores; many very fine tubular pores; few distinct intersecting slickensides on faces of peds with a slant of less than 45 degrees above the horizontal; cracks 1/4 inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; many carbonate coatings throughout; violently effervescent; moderately alkaline; gradual wavy boundary.

Bkss2—22 to 29 inches; olive gray (5Y 5/2) clay; few fine prominent light olive brown (2.5Y 5/4) iron concentrations; moderate fine prismatic structure parting to strong very fine angular blocky; very firm; common very fine roots in peds and pores; common very fine tubular pores; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; many carbonate coatings throughout; violently effervescent; moderately alkaline; gradual wavy boundary.

Bkg1—29 to 40 inches; dark grayish brown (2.5Y 4/2) clay; common fine prominent yellowish brown (10YR 5/6) iron concentrations; moderate fine prismatic structure parting to strong very fine angular blocky; very firm; few very fine roots in peds and pores; common very fine tubular pores; common carbonate coatings throughout; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bkg2—40 to 48 inches; dark grayish brown (2.5Y 4/2) clay; few fine prominent strong brown (7.5Y 5/6) and common fine prominent yellowish brown (10YR 5/6) iron concentrations; moderate fine prismatic structure parting to strong very fine angular blocky; very firm; common very fine tubular pores; common carbonate coatings throughout; strongly effervescent; moderately alkaline; clear wavy boundary.

BCg—48 to 55 inches; dark grayish brown (2.5Y 4/2) silty clay; common fine distinct yellowish brown (10YR 5/6) and many fine prominent strong brown (7.5YR 5/6) iron concentrations; moderate medium platy structure parting to moderate fine subangular blocky; firm; few very fine tubular pores; common fine and medium soft masses of carbonate; strongly effervescent; moderately alkaline; clear wavy boundary.

Cg—55 to 82 inches; light olive brown (2.5Y 5/2) silty clay; common fine prominent reddish brown (5YR 4/4) and many fine prominent strong brown (7.5YR 5/6) iron concentrations; medium platy and fine angular blocky soil fragments; very firm; few fine and medium soft masses of carbonate; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—1 to 3
Chroma—0 to 2
Texture—clay

Bkss and Bkg horizons:
Hue—2.5Y or 5Y
Value—3 to 5
Chroma—1 or 2
Texture—clay or silty clay

BCg horizon:
Hue—2.5Y or 5Y
Value—3 or 4
Chroma—1 or 2
Texture—silty clay or clay

Cg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 to 3
Texture—silty clay or clay

937—Eaglepoint-Northcote complex

Composition

Eaglepoint and similar soils: About 55 percent
Northcote and similar soils: About 40 percent
Inclusions: About 5 percent

Setting

Landform: Eaglepoint—flats and slight rises on lake plains; Northcote—swales on lake plains
Slope: 0 to 2 percent

Component Description

Eaglepoint

Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)

Drainage class: Somewhat poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.1 inches
Organic matter content: High

Northcote

Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Bearden and similar soils
- Colvin and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Eckvoll Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—rapid; lower part—moderate or moderately slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Loamy, mixed, superactive Aquic Arenic Eutroboralfs

Typical Pedon

Eckvoll loamy fine sand, 150 feet north and 2,500 feet east of the southwest corner of sec. 21, T. 155 N., R. 39 W.

Ap—0 to 8 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.

E—8 to 28 inches; brown (10YR 5/3) fine sand, light gray (10YR 7/2) dry; common medium distinct yellowish brown (10YR 5/6) and few fine faint dark brown (10YR 4/3) iron concentrations; single grain; loose; few fine roots; neutral; clear wavy boundary.

2Bt—28 to 33 inches; dark grayish brown (10YR 4/2) sandy clay loam; common fine distinct brown (7.5YR 4/4) iron concentrations and common medium faint dark grayish brown (2.5Y 4/2) iron depletions; moderate fine subangular blocky structure; friable; few fine roots; many distinct very dark gray (10YR 3/1), continuous clay films on faces of peds; 10 percent gravel; neutral; clear wavy boundary.

2BC—33 to 60 inches; grayish brown (2.5Y 5/2) loam; many medium distinct light olive brown (2.5Y 5/6) and common medium prominent yellowish brown (10YR 5/8) iron concentrations; weak fine subangular blocky structure; friable; many threads of carbonate; 8 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 22 to 48 inches
Thickness of the argillic horizon: 4 to 8 inches
Thickness of the sandy mantle: 20 to 36 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy fine sand

E horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—2 or 3
Texture—fine sand or sand
Content of rock fragments—0 to 2 percent

2Bt horizon:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 6
Chroma—2 to 4
Texture—sandy clay loam or clay loam
Content of rock fragments—2 to 10 percent

2BC horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2
Texture—loam or silt loam

Content of rock fragments—2 to 8 percent

565—Eckvoll loamy fine sand

Composition

Eckvoll and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kratka and similar soils
- Smiley and similar soils
- Reiner and similar soils
- Flaming and similar soils
- Radium and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Enstrom Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—rapid; lower part—moderately slow or moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Sandy over loamy, mixed, superactive, nonacid, frigid Aquic Udorthents

Typical Pedon

Enstrom loamy fine sand, 200 feet south and 1,700 feet east of the northwest corner of sec. 16, T. 158 N., R. 45 W.

Ap—0 to 7 inches; very dark gray (10YR 3/1) loamy fine sand, gray (10YR 5/1) dry; weak medium subangular blocky structure; very friable; few fine roots; neutral; abrupt smooth boundary.
Bw1—7 to 15 inches; brown (10YR 5/3) fine sand; common fine faint dark yellowish brown (10YR 4/4) and common medium distinct dark yellowish brown (10YR 4/6) iron concentrations; single grain; loose; neutral; gradual wavy boundary.
Bw2—15 to 25 inches; yellowish brown (10YR 5/4) fine sand; common fine distinct dark yellowish brown (10YR 4/6) iron concentrations; single grain; loose; neutral; clear wavy boundary.
2C—25 to 60 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent brownish yellow (10YR 6/6) and common medium prominent yellowish brown (10YR 5/8) iron concentrations; massive with weak fine subangular blocky soil fragments; friable; many soft masses of carbonates; 8 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches
Thickness of the sandy mantle: 25 to 40 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy fine sand

Bw horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—fine sand or sand

2C horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2
Texture—loam or silt loam
Content of rock fragments—2 to 8 percent

145—Enstrom loamy fine sand

Composition

Enstrom and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.5 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Grygla and similar soils
- Kratka and similar soils
- Poppleton and similar soils
- Foxhome and similar soils
- Mavie and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Espelie Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—moderately rapid; lower part—slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Sandy over clayey, mixed over smectitic, frigid Typic Epiaquolls

Typical Pedon

Espelie fine sandy loam, 750 feet south and 1,600 feet east of the northwest corner of sec. 8, T. 156 N., R. 42 W.

Ap—0 to 10 inches; black (N 2/0) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few very fine roots; neutral; abrupt smooth boundary.
Bg1—10 to 15 inches; grayish brown (2.5Y 5/2) loamy fine sand; common medium prominent light olive brown (2.5Y 5/6) iron concentrations; weak fine subangular blocky structure; very friable; 4 percent gravel; neutral; clear wavy boundary.
Bg2—15 to 25 inches; light brownish gray (2.5Y 6/2) fine sand; common medium prominent olive yellow (2.5Y 6/6) iron concentrations and common fine faint grayish brown (2.5Y 5/2) iron depletions; single grain; loose; 2 percent gravel; neutral; gradual wavy boundary.
Bg3—25 to 34 inches; light brownish gray (2.5Y 6/2) sand; few fine distinct light olive brown (2.5Y 5/6) iron concentrations and common fine faint grayish brown (2.5Y 5/2) iron depletions; single grain; loose; 3 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.
2Cg—34 to 60 inches; olive gray (5Y 4/2) clay; common medium prominent light olive brown (2.5Y 5/6) iron concentrations and common medium faint gray (5Y 5/1) iron depletions; massive with medium blocky soil fragments; firm; common fine threads of carbonate; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 17 to 40 inches
Thickness of the mollic epipedon: 8 to 16 inches
Thickness of the sandy mantle: 20 to 40 inches

A horizon:
Hue—neutral or 10YR
Value—2
Chroma—0 or 1
Texture—fine sandy loam

Bg horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—1 or 2
Texture—fine sand, loamy sand, loamy fine sand, or sand
Content of rock fragments—2 to 5 percent

2Cg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay or silty clay
Content of rock fragments—1 to 8 percent

645—Espelie fine sandy loam

Composition

Espelie and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.2 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hilaire and similar soils
- Clearwater and similar soils
- Thiefriver and similar soils
- Wyandotte and similar soils
- Hamar and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Fargo Series

Depth class: Very deep
Drainage class: Poorly drained and very poorly drained
Permeability: Slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Fine, smectitic, frigid Typic Epiaquerts

Typical Pedon

Fargo silty clay, 0 to 2 percent slopes (fig. 9), 2,500 feet north and 1,500 feet west of the southeast corner of sec. 31, T. 155 N., R. 48 W.

Ap—0 to 8 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; moderate fine subangular blocky structure parting to weak very fine granular; friable; common very fine and fine roots; neutral; abrupt smooth boundary.

A—8 to 11 inches; black (5Y 2.5/1) silty clay, very dark gray (5Y 3/1) dry; moderate fine subangular blocky structure; firm; common fine and very fine roots; slightly effervescent; neutral; clear wavy boundary.

Bssg—11 to 17 inches; dark gray (5Y 4/1) silty clay; moderate coarse prismatic structure parting to moderate fine angular blocky; firm; few fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 45 degrees above the horizontal; cracks 1/4 inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; slightly effervescent; neutral; clear wavy boundary.

Bkssg—17 to 30 inches; olive gray (5Y 5/2) silty clay; moderate coarse prismatic structure parting to moderate fine angular blocky; firm; few fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; common fine threads of carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bkg—30 to 43 inches; olive gray (5Y 5/2) silty clay; weak coarse prismatic structure parting to weak very fine subangular blocky; firm; few fine roots; many fine threads of carbonate; violently effervescent; moderately alkaline; clear smooth boundary.

Cg—43 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay; many medium distinct light olive brown

(2.5Y 5/4) and common fine and medium prominent strong brown (7.5YR 5/6) iron concentrations; massive with medium platy and blocky soil fragments; firm; common fine threads of carbonate; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 11 to 42 inches
Thickness of the mollic epipedon: 8 to 20 inches

Ap or A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay

Bssg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—2 to 4
Chroma—1 or 2
Texture—silty clay or clay

Bkssg and Bkg horizons:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 6
Chroma—1 or 2
Texture—silty clay or clay

Cg horizon:
Hue—2.5Y or 5Y
Value—3 to 5
Chroma—1 or 2
Texture—silty clay, clay, or silty clay loam

57A—Fargo silty clay, 0 to 2 percent slopes

Composition

Fargo and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Seasonal high water table: At the surface to 1.5 feet below the surface
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Colvin and similar soils
- Hegne and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1871—Fargo silty clay, swales

Composition

Fargo and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Swales and depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: Rare
Seasonal high water table: 0.5 foot above to 1.0 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Wahpeton and similar soils

- Colvin and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Flaming Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 3 percent
Taxonomic classification: Sandy, mixed Aquic Haploborolls

Typical Pedon

Flaming loamy fine sand, 150 feet north and 1,000 feet east of the southwest corner of sec. 33, T. 155 N., R. 47 W.

Ap—0 to 9 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; very friable; few fine roots; neutral; abrupt smooth boundary.

A—9 to 15 inches; very dark gray (10YR 3/1) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; very friable; few fine roots; slightly acid; clear wavy boundary.

Bw—15 to 29 inches; brown (10YR 4/3) fine sand; single grain; loose; few fine roots; neutral; clear wavy boundary.

C1—29 to 38 inches; light yellowish brown (2.5Y 6/4) fine sand; many medium faint olive yellow (2.5Y 6/6) iron concentrations and common fine faint light brownish gray (2.5Y 6/2) iron depletions; single grain; loose; slightly effervescent; slightly alkaline; clear wavy boundary.

C2—38 to 60 inches; grayish brown (2.5Y 5/2) fine sand; common medium prominent olive yellow (2.5Y 6/6) and few fine distinct yellowish brown (10YR 5/6) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to more than 60 inches
Thickness of the mollic epipedon: 10 to 16 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy fine sand

Bw horizon:
Hue—10YR
Value—3 to 5
Chroma—2 to 4
Texture—fine sand, loamy fine sand, or sand

C horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—fine sand

66—Flaming loamy fine sand

Composition

Flaming and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 5.4 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Radium and similar soils
- Grimstad and similar soils
- Rosewood and similar soils
- Hamar and similar soils
- Poppleton and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1006—Fluvaquents-Haploborolls complex, 0 to 30 percent slopes, flooded

Composition

Fluvaquents and similar soils: About 45 percent
Haploborolls and similar soils: About 45 percent
Inclusions: About 10 percent

Setting

Landform: Fluvaquents—flats and swales on flood plains; Haploborolls—backslopes and shoulders on flood plains
Slope: Fluvaquents—0 to 2 percent; Haploborolls—2 to 30 percent

Component Description

Fluvaquents

Surface layer texture: Very fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Alluvium
Flooding: Frequent
Seasonal high water table: At the surface to 3 feet below the surface
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches
Organic matter content: High

Haploborolls

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: Rare
Depth to the water table: 2.5 to 5.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: Moderate

Inclusions

- Soils that have steeper slopes
- Dominantly sandy soils
- Dominantly clayey soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Foldahl Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—rapid; lower part—moderately slow or moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Sandy over loamy, mixed, superactive Aquic Haploborolls

Typical Pedon

Foldahl loamy fine sand, 2,500 feet south and 750 feet east of the northwest corner of sec. 12, T. 157 N., R. 46 W.

Ap—0 to 9 inches; black (10YR 2/1) loamy fine sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.
A—9 to 13 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; single grain; loose; few fine roots; slightly acid; clear smooth boundary.
Bw1—13 to 23 inches; brown (10YR 4/3) sand; single grain; loose; few fine roots; neutral; clear smooth boundary.
Bw2—23 to 33 inches; dark yellowish brown (10YR 4/4) sand; few medium distinct dark brown (7.5YR 4/4) and common fine distinct yellowish brown (10YR 5/6) iron concentrations; single grain; loose; neutral; clear smooth boundary.
2C—33 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium distinct olive yellow (2.5Y 6/6) and common medium distinct light olive brown (2.5Y 5/6) iron concentrations; massive with medium blocky soil fragments; friable; common fine soft masses of carbonates; 8 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 21 to 32 inches
Thickness of the mollic epipedon: 10 to 16 inches
Thickness of the sandy mantle: 20 to 40 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3

Chroma—1 or 2
Texture—loamy fine sand or loamy sand
Content of rock fragments—0 to 5 percent

Bw horizon:
Hue—10YR
Value—3 or 4
Chroma—2 to 4
Texture—sand or fine sand
Content of rock fragments—0 to 5 percent

2C horizon:
Hue—2.5Y or 10YR
Value—5 to 7
Chroma—2 to 4
Texture—loam
Content of rock fragments—5 to 10 percent

426—Foldahl loamy fine sand

Composition

Foldahl and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.9 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Strathcona and similar soils
- Vallers and similar soils
- Grimstad and similar soils
- Flaming and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Foxhome Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderately rapid; next part—rapid; lower part—moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Sandy-skeletal over loamy, mixed, superactive Aquic Haploborolls

Typical Pedon

Foxhome sandy loam, 200 feet south and 2,200 feet east of the northwest corner of sec. 12, T. 154 N., R. 45 W.

Ap—0 to 8 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few very fine roots; slightly alkaline; abrupt smooth boundary.

Bw1—8 to 14 inches; dark brown (10YR 3/3) loamy sand; weak fine subangular blocky structure; very friable; few very fine roots; 12 percent gravel; neutral; clear smooth boundary.

2Bw2—14 to 20 inches; brown (10YR 4/3) very gravelly coarse sand; single grain; loose; 55 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

2Bw3—20 to 26 inches; yellowish brown (10YR 5/4) very gravelly coarse sand; common fine distinct dark grayish brown (10YR 4/2) iron depletions and few fine faint light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; 65 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

3BC—26 to 60 inches; grayish brown (2.5Y 5/2) loam; common medium distinct light olive brown (2.5Y 5/6) iron concentrations; weak medium subangular blocky structure; friable; few medium soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 11 to 16 inches
Thickness of the mollic epipedon: 7 to 12 inches

Thickness of the sandy mantle: 15 to 38 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—sandy loam
Content of rock fragments—0 to 5 percent

Bw horizon:
Hue—10YR
Value—3 or 4
Chroma—2 or 3
Texture—gravelly loamy sand, gravelly sandy loam, or loamy sand
Content of rock fragments—10 to 20 percent

2Bw horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—very gravelly coarse sand, very gravelly loamy sand, or very gravelly sand
Content of rock fragments—35 to 65 percent

3BC horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2 or 3
Texture—loam or silt loam
Content of rock fragments—1 to 10 percent

65—Foxhome sandy loam

Composition

Foxhome and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Mavie and similar soils
- Roliss and similar soils
- Foldahl and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Garnes Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Fine-loamy, mixed, superactive Aquic Eutroboralfs

Typical Pedon

Garnes fine sandy loam, 200 feet south and 1,400 feet east of the northwest corner of sec. 30, T. 158 N., R. 41 W.

A—0 to 4 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

E—4 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; neutral; abrupt smooth boundary.

Bt—10 to 17 inches; brown (10YR 4/3) clay loam; few medium faint dark grayish brown (10YR 4/2) iron depletions; moderate fine and medium subangular blocky structure; friable; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 2 percent gravel; neutral; clear wavy boundary.

Bk—17 to 26 inches; grayish brown (2.5Y 5/2) loam; few fine faint dark grayish brown (2.5Y 4/2) iron depletions; weak medium subangular blocky structure; very friable; common fine carbonate coatings on faces of peds and in pores; 3 percent gravel; strongly effervescent; slightly alkaline; gradual wavy boundary.

C—26 to 60 inches; light olive brown (2.5Y 5/4) loam; few medium distinct dark grayish brown (2.5Y 4/2) iron depletions; massive with fine and medium blocky soil fragments; very friable; many fine carbonate coatings on faces of peds and in pores; 8 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 13 to 17 inches
Thickness of the surface layer: 4 to 6 inches
Thickness of the sandy mantle: 8 to 18 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—fine sandy loam

E horizon:
Hue—10YR
Value—4
Chroma—2 or 3
Texture—fine sandy loam or loamy fine sand

Bt horizon:
Hue—10YR
Value—4
Chroma—2 or 3
Texture—clay loam or sandy clay loam
Content of rock fragments—2 to 5 percent

Bk and C horizons:
Hue—2.5Y
Value—5 to 7
Chroma—2 to 4
Texture—loam
Content of rock fragments—3 to 8 percent

77—Garnes fine sandy loam

Composition

Garnes and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Smiley and similar soils
- Grygla and similar soils
- Linveldt and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Glyndon Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderate; lower part—moderately rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 6 percent
Taxonomic classification: Coarse-silty, mixed, superactive, frigid Aeric Calciaquolls

Typical Pedon

Glyndon very fine sandy loam, 0 to 2 percent slopes, 1,000 feet north and 100 feet east of the southwest corner of sec. 22, T. 158 N., R. 47 W.

Ap—0 to 9 inches; black (10YR 2/1) very fine sandy loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; very friable; few fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 18 inches; dark gray (10YR 4/1) loamy very fine sand; weak fine subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—18 to 23 inches; dark grayish brown (10YR 4/2) loamy very fine sand; weak fine subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.

C1—23 to 35 inches; light yellowish brown (2.5Y 6/4) loamy very fine sand; few fine faint olive yellow (2.5Y 6/6) iron concentrations; massive; very friable; strongly effervescent; slightly alkaline; clear smooth boundary.

C2—35 to 60 inches; light brownish gray (2.5Y 6/2) loamy very fine sand; many medium distinct olive yellow (2.5Y 6/8) iron concentrations and many medium faint light gray (2.5Y 7/2) iron depletions; massive; very friable; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 11 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—very fine sandy loam

Bk horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—1 to 3
Texture—loamy very fine sand, very fine sandy loam, loam, or silt loam

C horizon:
Hue—2.5Y
Value—4 to 7
Chroma—2 to 4
Texture—loamy very fine sand, very fine sand, very fine sandy loam, silt loam, or loam

1304A—Glyndon very fine sandy loam, 0 to 2 percent slopes

Composition

Glyndon and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Very fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Borup and similar soils
- Rosewood and similar soils
- Wheatville and similar soils
- Ulen and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1304B—Glyndon very fine sandy loam, 2 to 6 percent slopes

Composition

Glyndon and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Lake plains
Position on the landform: Backslopes
Slope: 2 to 6 percent

Component Description

Surface layer texture: Very fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Borup and similar soils
- Lamoure and similar soils
- Ulen and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Grimstad Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderately rapid or rapid; lower part—moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Sandy over loamy, mixed, superactive, frigid Aeric Calciaquolls

Typical Pedon

Grimstad fine sandy loam, 1,850 feet north and 500 feet east of the southwest corner of sec. 36, T. 155 N., R. 46 W.

Ap—0 to 10 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk—10 to 17 inches; dark gray (10YR 4/1) loamy fine sand; weak fine subangular blocky structure; very friable; few fine roots; few very dark gray (10YR 3/1) organic coatings in root channels; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

C1—17 to 29 inches; light yellowish brown (2.5Y 6/4) fine sand; few fine and common medium faint light brownish gray (2.5Y 6/2) iron depletions and common fine faint olive yellow (2.5Y 6/6) iron concentrations; single grain; loose; 1 percent gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.

2C2—29 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium faint light gray (2.5Y 7/2) iron depletions and common fine prominent olive yellow (2.5Y 6/8) and many medium prominent light olive brown (2.5Y 5/6) iron concentrations; massive with fine blocky soil fragments; friable; common fine irregular soft masses of carbonates; 8 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 14 inches
Thickness of the sandy mantle: 20 to 40 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—fine sandy loam
Content of rock fragments—0 to 1 percent

Bk horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—loamy sand, loamy fine sand, fine sandy loam, or very fine sandy loam
Content of rock fragments—0 to 1 percent

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—sand or fine sand
Content of rock fragments—0 to 1 percent

2C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—fine sandy loam, loam, or silt loam
Content of rock fragments—1 to 8 percent

59—Grimstad fine sandy loam

Composition

Grimstad and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam

Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.3 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Vallers and similar soils
- Rosewood and similar soils
- Kratka and similar soils
- Ulen and similar soils
- Foldahl and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Grygla Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—rapid; lower part—moderately slow or moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Sandy over loamy, mixed, superactive, nonacid, frigid Mollic Endoaquents

Typical Pedon

Grygla loamy fine sand, 200 feet south and 2,150 feet west of the northeast corner of sec. 25, T. 158 N., R. 39 W.

Ap—0 to 7 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; very friable; few very fine roots; neutral; abrupt smooth boundary.

Bg1—7 to 18 inches; light brownish gray (2.5Y 6/2) fine sand; few fine distinct olive yellow (2.5Y 6/6) and many fine faint light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; neutral; gradual wavy boundary.

Bg2—18 to 33 inches; grayish brown (2.5Y 5/2) fine sand; many medium distinct light olive brown (2.5Y 5/6) and few fine prominent yellowish red (5YR 5/8) iron concentrations; single grain; loose; neutral; clear wavy boundary.

2Bg3—33 to 60 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent yellowish brown (10YR 5/8) iron concentrations; weak very fine and medium subangular blocky structure; firm; common fine irregular soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches
Thickness of the surface layer: 5 to 8 inches
Thickness of the sandy mantle: 20 to 40 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy fine sand

Bg horizon:
Hue—2.5Y or 10YR
Value—5 or 6
Chroma—2
Texture—fine sand, sand, or loamy fine sand
Content of rock fragments—0 to 3 percent

2Bg horizon:
Hue—2.5Y
Value—4 to 6
Chroma—2
Texture—loam or silt loam
Content of rock fragments—1 to 5 percent

482—Grygla loamy fine sand

Composition

Grygla and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.1 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Berner and similar soils
- Eckvoll and similar soils
- Smiley and similar soils
- Northwood and similar soils
- Strathcona and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Hamar Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Sandy, mixed, frigid Typic Endoaquolls

Typical Pedon

Hamar loamy fine sand, 1,700 feet north and 400 feet east of the southwest corner of sec. 14, T. 157 N., R. 46 W.

Ap—0 to 7 inches; black (10YR 2/1) loamy fine sand, very dark grayish brown (2.5Y 3/2) dry; weak fine granular structure; very friable; few fine roots; slightly alkaline; abrupt smooth boundary.
AC—7 to 20 inches; very dark brown (10YR 2/2) loamy fine sand, very dark gray (10YR 3/1) dry; single grain; loose; few fine roots; neutral; clear wavy boundary.
Cg1—20 to 31 inches; dark grayish brown (2.5Y 4/2) fine sand; few fine distinct olive brown (2.5Y 4/4) iron concentrations; single grain; loose; slightly alkaline; clear wavy boundary.
Ab—31 to 33 inches; very dark grayish brown (10YR 3/2) fine sand; single grain; loose; neutral; clear wavy boundary.
Cg2—33 to 56 inches; grayish brown (2.5Y 5/2) fine sand; common fine faint dark grayish brown (2.5Y 4/2) iron depletions; single grain; loose; slightly alkaline; clear wavy boundary.
Cg3—56 to 60 inches; olive gray (5Y 5/2) fine sand; few fine distinct light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; 1 percent gravel; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 11 to 20 inches

A horizon:
Hue—10YR
Value—2
Chroma—1
Texture—loamy fine sand

AC horizon:
Hue—10YR
Value—2
Chroma—2
Texture—loamy fine sand

Cg horizons:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—2
Texture—fine sand
Content of rock fragments—0 to 1 percent

Ab horizon:
Hue—10YR
Value—3
Chroma—2
Texture—fine sand

372—Hamar loamy fine sand

Composition

Hamar and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains

Slope: 0 to 2 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Seasonal high water table: At the surface to 1.5 feet below the surface
Available water capacity to 60 inches or root-limiting layer: About 5.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Flaming and similar soils
- Deerwood and similar soils
- Northwood and similar soils
- Syrene and similar soils
- Kratka and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Hamerly Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Till
Slope range: 0 to 3 percent
Taxonomic classification: Fine-loamy, mixed, superactive, frigid Aeric Calciaquolls

Typical Pedon

Hamerly loam, 0 to 3 percent slopes, 1,400 feet south and 1,850 feet east of the northwest corner of sec. 17, T. 156 N., R. 45 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; 1 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 16 inches; grayish brown (2.5Y 5/2) loam; weak medium subangular blocky structure; very friable; few fine roots; disseminated carbonates; 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—16 to 24 inches; light yellowish brown (2.5Y 6/4) loam; weak medium subangular blocky structure; friable; common fine masses of carbonates; 3 percent gravel; strongly effervescent; slightly alkaline; gradual wavy boundary.

C—24 to 60 inches; light yellowish brown (2.5Y 6/4) loam; common fine distinct light brownish gray (10YR 6/2) iron depletions and common medium faint light olive brown (2.5Y 5/4) iron concentrations; massive with medium blocky soil fragments; friable; common fine masses of carbonates; 3 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 10 inches

A horizon:
Hue—10YR or 2.5Y
Value—2
Chroma—1 or 2
Texture—loam
Content of rock fragments—0 to 3 percent

Bk horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—1 to 4
Texture—loam
Content of rock fragments—1 to 3 percent

C horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam
Content of rock fragments—1 to 5 percent

184A—Hamerly loam, 0 to 3 percent slopes

Composition

Hamerly and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 1.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Roliss and similar soils
- Grimstad and similar soils
- Strathcona and similar soils
- Foxhome and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Hamre Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow or moderate
Landform: Lake plains
Parent material: Organic materials and till
Slope range: 0 to 1 percent
Taxonomic classification: Fine-loamy, mixed, superactive, nonacid, frigid Histic Humaquepts

Typical Pedon

Hamre muck, 2,500 feet north and 1,350 feet west of the southeast corner of sec. 23, T. 157 N., R. 43 W.

Oa—0 to 9 inches; black (N 2/0) muck; 10 percent fiber, 3 percent rubbed; moderate fine granular structure; very friable; many fine and medium roots; moderately acid; clear smooth boundary.

A—9 to 14 inches; black (N 2/0) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine and medium roots; 2 percent gravel; neutral; clear smooth boundary.

Bg1—14 to 29 inches; olive gray (5Y 5/2) loam; common fine prominent light olive brown (2.5Y 5/6) and few medium prominent dark yellowish brown (10YR 4/6) iron concentrations; weak fine subangular blocky structure; friable; common fine roots; common fine threads of carbonate; 3 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

Bg2—29 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium distinct light yellowish brown (2.5Y 6/4) and common fine and medium prominent light olive brown (2.5Y 5/6) iron concentrations; weak fine subangular blocky structure; friable; few fine roots; disseminated carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 12 to 20 inches
Thickness of the histic epipedon: 8 to 16 inches

Oa horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—muck

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—2 or 3
Chroma—0 to 2
Texture—loam, clay loam, or fine sandy loam
Content of rock fragments—0 to 2 percent

Bg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 to 3
Texture—loam or clay loam
Content of rock fragments—1 to 5 percent

1878—Hamre muck

Composition

Hamre and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains

Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 12.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Smiley and similar soils
- Strathcona and similar soils
- Vallers and similar soils
- Cathro and similar soils
- Soils that are ponded
- Northwood and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1804—Hamre muck, ponded

Composition

Hamre and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 12.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Cathro and similar soils
- Soils that have a mineral surface layer
- Northwood and similar soils
- Berner and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Hangaard Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—rapid; lower part—very rapid
Landform: Beach deposits on lake plains
Parent material: Beach deposits
Slope range: 0 to 2 percent
Taxonomic classification: Sandy, mixed, frigid Typic Endoaquolls

Typical Pedon

Hangaard sandy loam, 1,600 feet north and 100 feet east of the southwest corner of sec. 6, T. 158 N., R. 39 W.

Ap—0 to 8 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; few very fine roots; 2 percent gravel; neutral; abrupt smooth boundary.

Ag—8 to 14 inches; very dark grayish brown (2.5Y 3/2) loamy sand; weak fine granular structure; very friable; few very fine roots; 10 percent gravel; neutral; clear smooth boundary.

Cg1—14 to 20 inches; grayish brown (2.5Y 5/2) gravelly coarse sand; common fine distinct yellowish brown (10YR 5/4) iron concentrations; single grain; loose; 20 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

Cg2—20 to 30 inches; light brownish gray (2.5Y 6/2) gravelly coarse sand; common fine prominent yellowish brown (10YR 5/6) iron concentrations; single grain; loose; 20 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

Cg3—30 to 38 inches; light brownish gray (2.5Y 6/2) sand; common fine distinct brown (10YR 5/3) iron concentrations; single grain; loose; 5 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

Cg4—38 to 60 inches; light brownish gray (2.5Y 6/2) gravelly coarse sand; common fine distinct yellowish brown (10YR 5/4) iron concentrations; single grain; loose; 25 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 14 to 30 inches
Thickness of the mollic epipedon: 7 to 16 inches
Content of rock fragments: Averages 10 to 35 percent in the 10- to 40-inch control section

Ap horizon:
Hue—10YR or neutral
Value—2
Chroma—0 or 1
Texture—sandy loam
Content of rock fragments—0 to 5 percent

Ag horizon:
Hue—10YR or 2.5Y
Value—3
Chroma—1 or 2
Texture—loamy sand, sandy loam, or fine sandy loam
Content of rock fragments—0 to 10 percent

Cg horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2
Texture—gravelly coarse sand, coarse sand, gravelly sand, very gravelly coarse sand, or stratified sand or fine sand
Content of rock fragments—5 to 50 percent

111—Hangaard sandy loam

Composition

Hangaard and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on beach plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 2.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Radium and similar soils
- Flaming and similar soils
- Deerwood and similar soils
- Mavie and similar soils
- Kratka and similar soils
- Sahkahtay and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Haug Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderate or moderately rapid
Landform: Lake plains
Parent material: Organic materials and till

Slope range: 0 to 1 percent
Taxonomic classification: Coarse-loamy, mixed, calcareous, frigid Histic Humaquepts

Typical Pedon

Haug muck, 2,100 feet south and 1,000 feet west of the northeast corner of sec. 35, T. 158 N., R. 45 W.

Oa—0 to 8 inches; black (N 2/0) muck; 20 percent fiber, trace rubbed; weak very fine granular structure; very friable; slightly alkaline; clear smooth boundary.
A—8 to 17 inches; black (N 2/0) loam; weak fine granular structure; friable; strongly effervescent; slightly alkaline; abrupt smooth boundary.
Bkg1—17 to 24 inches; light brownish gray (2.5Y 6/2) loam; common fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak very fine subangular blocky structure; friable; 2 percent gravel; many fine masses of carbonates; strongly effervescent; moderately alkaline; clear smooth boundary.
Bkg2—24 to 35 inches; light brownish gray (2.5Y 6/2) loam; many fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak very fine subangular blocky structure; friable; 2 percent gravel; many fine masses of carbonates; strongly effervescent; moderately alkaline; clear smooth boundary.
Bg1—35 to 44 inches; light gray (2.5Y 7/2) loam; many fine prominent yellowish brown (10YR 5/6) iron concentrations; weak very fine subangular blocky structure; friable; 3 percent gravel; common fine masses of carbonates; strongly effervescent; slightly alkaline; gradual smooth boundary.
Bg2—44 to 60 inches; light gray (2.5Y 7/2) loam; many medium prominent yellowish brown (10YR 5/6) iron concentrations; weak very fine subangular blocky structure; friable; 3 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 8 to 11 inches
Thickness of the histic epipedon: 8 to 16 inches

Oa horizon:
Hue—neutral
Value—2
Chroma—0
Texture—muck

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—loam or sandy loam
Content of rock fragments—0 to 8 percent

Bkg and Bg horizons:
Hue—2.5Y or 5Y
Value—4 to 7
Chroma—1 or 2
Texture—loam or sandy loam
Content of rock fragments—2 to 12 percent

187—Haug muck

Composition

Haug and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Percy and similar soils
- Cathro and similar soils
- Strathcona and similar soils
- Other soils that are ponded
- Northwood and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Hegne Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Fine, smectitic, frigid Typic Calciaquerts

Typical Pedon

Hegne silty clay, in an area of Hegne-Fargo complex, 600 feet south and 2,100 feet east of the northwest corner of sec. 22, T. 157 N., R. 49 W.

Apk—0 to 10 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; common fine distinct olive gray (5Y 4/2) iron depletions; strong fine and medium subangular blocky structure; firm; few fine and medium roots; many fine soft masses of carbonates; slightly effervescent; slightly alkaline; clear wavy boundary.

Bkssg1—10 to 18 inches; about 60 percent olive gray (5Y 4/2) and 40 percent dark gray (5Y 6/1) silty clay, light gray (5Y 6/1) and gray (5Y 5/1) dry; moderate medium subangular blocky structure; firm; few fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 45 degrees above the horizontal; cracks 1/4 inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; many fine soft masses of carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bkssg2—18 to 34 inches; olive gray (5Y 5/2) silty clay, light olive gray (5Y 6/2) dry; common fine faint dark gray (5Y 4/1) iron depletions; moderate fine and medium subangular blocky structure; firm; few very fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; many fine soft masses of carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bg—34 to 50 inches; olive gray (5Y 4/2) silty clay; common medium distinct light olive brown (2.5YR 5/4) iron concentrations; weak fine and medium subangular blocky structure; friable; few fine soft masses of carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Cg—50 to 60 inches; olive gray (5Y 5/2) silty clay; common medium distinct gray (5Y 5/1) iron depletions and common medium prominent strong brown (7.5YR 4/6) and fine reddish yellow (7.5YR 6/6) iron concentrations; weak fine and medium subangular blocky soil fragments parting to weak thin platy; firm; few medium carbonate coatings on faces of peds; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches

Apk horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay

Bkssg horizon:
Hue—5Y, 2.5Y, or 10YR
Value—4 to 6
Chroma—1 or 2
Texture—silty clay or clay

Bg horizon:
Hue—5Y or 2.5Y
Value—3 to 6
Chroma—1 or 2
Texture—clay or silty clay

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—silty clay or clay

935—Hegne-Fargo complex

Composition

Hegne and similar soils: About 50 percent
Fargo and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Hegne—flats and slight rises on lake plains; Fargo—swales on lake plains
Slope: 0 to 2 percent

Component Description

Hegne

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.0 inches

Organic matter content: High

Fargo

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Seasonal high water table: At the surface to 1.5 feet below the surface
Available water capacity to 60 inches or root-limiting layer: About 9.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Bearden and similar soils
- Colvin and similar soils
- Northcote and similar soils
- Eaglepoint and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Hilaire Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—rapid; lower part—slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Sandy over clayey, mixed over smectitic Aquic Haploborolls

Typical Pedon

Hilaire loamy fine sand, 1,800 feet north and 2,500 feet east of the southwest corner of sec. 6, T. 155 N., R. 47 W.

Ap—0 to 11 inches; black (10YR 2/1) loamy fine sand, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; very friable; few very fine roots; 1 percent gravel; neutral; abrupt smooth boundary.

Bw1—11 to 22 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) fine sand; weak fine subangular blocky structure; very friable; few very fine roots; 1 percent gravel; neutral; clear wavy boundary.

Bw2—22 to 34 inches; light olive brown (2.5Y 5/4) fine sand; common fine and medium distinct dark brown (10YR 4/3) iron concentrations; single grain; loose; 1 percent gravel; slightly alkaline; clear smooth boundary.

2Bk—34 to 60 inches; olive gray (5Y 4/2) clay; many fine and medium faint very dark gray (5Y 3/1) iron depletions and common fine prominent olive brown (2.5Y 4/4) iron concentrations; moderate medium angular blocky structure; firm; common fine soft masses of carbonates; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 6 to 34 inches
Thickness of the mollic epipedon: 10 to 12 inches
Thickness of the sandy mantle: 20 to 40 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—loamy fine sand
Content of rock fragments—0 to 2 percent

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—2 to 4
Texture—fine sand or loamy fine sand
Content of rock fragments—0 to 2 percent

2Bk horizon:
Hue—5Y or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay or silty clay
Content of rock fragments—0 to 5 percent

647—Hilaire loamy fine sand

Composition

Hilaire and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 5.0 feet
Available water capacity to 60 inches or root-limiting layer: About 7.3 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Wyandotte and similar soils
- Clearwater and similar soils
- Flaming and similar soils
- Thiefriver and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Huot Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderately rapid; lower part—slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Sandy over clayey, mixed over smectitic, frigid Aquic Calciborolls

Typical Pedon

Huot fine sandy loam, 1,700 feet north and 800 feet east of the southwest corner of sec. 1, T. 154 N., R. 44 W.

Ap—0 to 9 inches; black (N 2/0) fine sandy loam, black (10YR 2/1) dry; weak fine subangular blocky structure; very friable; few fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 16 inches; dark gray (10YR 4/1) loamy fine sand; weak fine subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—16 to 21 inches; grayish brown (2.5Y 5/2) fine sand; few fine distinct light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; disseminated carbonates; strongly effervescent; slightly alkaline; clear wavy boundary.

C1—21 to 29 inches; yellowish brown (10YR 5/4) fine sand; few fine faint yellowish brown (10YR 5/6) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline; clear wavy boundary.

2C2—29 to 60 inches; dark gray (5Y 4/1) silty clay; few medium prominent dark yellowish brown (10YR 4/6) iron concentrations; moderate medium subangular blocky structure; firm; few fine masses of carbonates; 2 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 14 inches
Thickness of the sandy mantle: 20 to 40 inches

A horizon:
Hue—10YR or neutral
Value—2
Chroma—0 or 1
Texture—fine sandy loam

Bk horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—1 to 3
Texture—loamy fine sand or fine sand

C horizon:
Hue—2.5Y or 10YR
Value—4 to 6
Chroma—3 or 4
Texture—fine sand or loamy fine sand

2C horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay, clay, or clay loam
Content of rock fragments—1 to 5 percent

643—Huot fine sandy loam

Composition

Huot and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.3 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Wyandotte and similar soils
- Espelie and similar soils
- Hilaire and similar soils
- Soils that have less clay in the substratum
- Clearwater and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Karlstad Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderately rapid; lower part—rapid
Landform: Beach ridges on lake plains
Parent material: Beach deposits
Slope range: 0 to 3 percent
Taxonomic classification: Coarse-loamy, mixed, superactive Aquic Eutroboralfs

Typical Pedon

Karlstad loamy sand, 1,200 feet south and 350 feet west of the northeast corner of sec. 36, T. 158 N., R. 44 W.

A—0 to 3 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; few fine roots; 2 percent gravel; neutral; clear smooth boundary.
E1—3 to 6 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; few fine roots; 2 percent gravel; neutral; clear smooth boundary.
E2—6 to 12 inches; brown (10YR 5/3) sand; common fine distinct brownish yellow (10YR 6/6) iron concentrations and few fine faint grayish brown (10YR 5/2) iron depletions; single grain; loose; few fine roots; 2 percent gravel; slightly acid; clear wavy boundary.
Bt1—12 to 16 inches; brown (10YR 4/3) sandy loam; few fine distinct dark yellowish brown (10YR 4/6) iron concentrations; moderate medium subangular blocky structure; friable; few fine roots; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 5 percent gravel; neutral; clear wavy boundary.
2Bt2—16 to 19 inches; brown (10YR 4/3) gravelly sandy loam; few fine distinct dark yellowish brown (10YR 3/6) iron concentrations and few fine faint dark grayish brown (10YR 4/2) iron depletions; moderate medium subangular blocky structure; friable; few roots matted around stones; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 20 percent gravel; neutral; clear smooth boundary.
2C—19 to 60 inches; pale brown (10YR 6/3) very gravelly coarse sand; common fine faint brown (10YR 5/3) and few fine distinct brownish yellow (10YR 6/6) iron concentrations; single grain; loose; 50 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 12 to 24 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand
Content of rock fragments—0 to 15 percent

E horizon:
Hue—10YR

Value—4 to 6
Chroma—2 or 3
Texture—sand or loamy sand
Content of rock fragments—0 to 5 percent

Bt horizon:
Hue—10YR or 7.5YR
Value—3 to 5
Chroma—2 to 4
Texture—sandy loam or sandy clay loam
Content of rock fragments—0 to 10 percent

2Bt horizon:
Hue—10YR
Value—4
Chroma—3
Texture—gravelly sandy loam
Content of rock fragments—15 to 25 percent

2C horizon:
Hue—10YR or 2.5Y
Value—5 to 7
Chroma—2 to 4
Texture—very gravelly coarse sand, very gravelly loamy sand, gravelly coarse sand, gravelly sand, coarse sand, sand, or fine sand
Content of rock fragments—5 to 50 percent

205—Karlstad loamy sand

Composition

Karlstad and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on beach plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 3.6 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Strandquist and similar soils
- Syrene and similar soils
- Radium and similar soils
- Marquette and similar soils
- Kratka and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Kittson Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow or moderate
Landform: Lake plains
Parent material: Loamy glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Fine-loamy, mixed Aquic Haploborolls

Typical Pedon

Kittson loam, 200 feet south and 1,850 feet east of the northwest corner of sec. 25, T. 155 N., R. 45 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; few fine roots; 1 percent gravel; slightly alkaline; abrupt smooth boundary.

AB—8 to 11 inches; very dark gray (10YR 3/1) and dark brown (10YR 4/3) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; few fine roots; 1 percent gravel; neutral; clear wavy boundary.

Bw—11 to 15 inches; dark brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; very friable; 1 percent gravel; neutral; clear wavy boundary.

2Bk1—15 to 23 inches; light yellowish brown (2.5Y 6/4) loam; few fine prominent yellowish brown (10YR 5/6) iron concentrations and few fine distinct grayish brown (10YR 5/2) iron depletions; weak fine subangular blocky structure; friable; common fine masses of carbonates; 3 percent gravel; strongly effervescent; slightly alkaline; gradual wavy boundary.

2Bk2—23 to 33 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent yellowish brown (10YR 5/6) and many medium and coarse distinct light yellowish brown (2.5Y 6/4) iron concentrations; weak fine subangular blocky structure; friable; common fine masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

2C—33 to 60 inches; light brownish gray (2.5Y 6/2) loam; many coarse distinct light yellowish brown (2.5Y 6/4) iron concentrations; massive with fine blocky soil fragments; friable; common fine masses of carbonates; 5 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 11 to 15 inches
Thickness of the mollic epipedon: 7 to 10 inches

A horizon:
Hue—10YR
Value—2
Chroma—1
Texture—loam
Content of rock fragments—0 to 1 percent

AB horizon:
Hue—10YR
Value—3 or 4
Chroma—1 to 3
Texture—sandy loam, fine sandy loam, or loam
Content of rock fragments—0 to 1 percent

Bw horizon:
Hue—10YR
Value—3 or 4
Chroma—2 or 3
Texture—fine sandy loam, loam, or sandy loam
Content of rock fragments—0 to 1 percent

2Bk and 2C horizons:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—loam
Content of rock fragments—2 to 5 percent

58—Kittson loam

Composition

Kittson and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Foldahl and similar soils
- Hamerly and similar soils
- Roliss and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Kratka Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—moderately rapid or rapid; lower part—moderate or moderately slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Sandy over loamy, mixed, superactive, frigid Typic Endoaquolls

Typical Pedon

Kratka fine sandy loam, 200 feet south and 100 feet east of the northwest corner of sec. 11, T. 154 N., R. 39 W.

Ap—0 to 9 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to moderate fine granular; very friable; few very fine roots; neutral; abrupt smooth boundary.

A—9 to 13 inches; very dark grayish brown (10YR 3/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; few fine prominent dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/8) iron concentrations; weak medium subangular blocky structure; very friable; few very fine roots; 1 percent gravel; neutral; clear smooth boundary.

Bg—13 to 26 inches; dark grayish brown (2.5Y 4/2) fine sand; common medium prominent yellowish brown (10YR 5/6) iron concentrations; single grain; loose; 1 percent gravel; neutral; clear wavy boundary.

2Bkg—26 to 60 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent yellowish brown (10YR 5/6) iron concentrations; moderate medium subangular blocky structure; friable; common fine and medium soft masses of carbonates; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 20 to 40 inches
Thickness of the mollic epipedon: 8 to 15 inches
Thickness of the sandy mantle: 20 to 40 inches

Ap and A horizons:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—fine sandy loam or loamy fine sand

Bg horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 to 4
Texture—fine sand, sand, loamy fine sand, or loamy sand
Content of rock fragments—0 to 5 percent

2Bkg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2 or 3
Texture—loam or clay loam
Content of rock fragments—1 to 5 percent

481—Kratka fine sandy loam

Composition

Kratka and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.9 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Foldahl and similar soils
- Smiley and similar soils
- Northwood and similar soils
- Deerwood and similar soils
- Strandquist and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Lamoure Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate or moderately slow
Landform: Flood plains
Parent material: Alluvium
Slope range: 0 to 2 percent
Taxonomic classification: Fine-silty, mixed, superactive, calcareous, frigid Cumulic Endoaquolls

Typical Pedon

Lamoure silty clay loam, occasionally flooded, 2,750 feet south and 1,950 feet east of the northwest corner of sec. 6, T. 156 N., R. 48 W.

Ap—0 to 10 inches; black (N 2/0) silty clay loam, very dark gray (N 3/0) dry; weak very fine subangular blocky structure; friable; few very fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.
A—10 to 15 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; few very fine roots; few snail shells; common fine threads of carbonate; strongly effervescent; slightly alkaline; clear smooth boundary.
Cg1—15 to 21 inches; very dark grayish brown (2.5Y 3/2) silty clay loam, gray (10YR 5/1) dry; few fine prominent strong brown (7.5YR 4/6) iron concentrations; massive with weak very fine subangular blocky fragments; friable; few very fine roots; few snail shells; common fine threads of carbonate; strongly effervescent; slightly alkaline; clear smooth boundary.
Cg2—21 to 42 inches; very dark grayish brown (2.5Y 3/2) silt loam, gray (10YR 5/1) dry; common fine prominent dark brown (7.5YR 3/4) iron concentrations and light brownish gray (2.5Y 6/2) iron depletions; massive with weak very fine blocky fragments; friable; few very fine roots; few snail shells; common fine threads of carbonate; strongly effervescent; slightly alkaline; abrupt smooth boundary.
Ab—42 to 49 inches; black (5Y 2.5/1) silty clay, dark gray (10YR 4/1) dry; few fine prominent strong brown (7.5YR 4/6) iron concentrations; moderate very fine subangular blocky structure; firm; few snail shells; slightly effervescent; slightly alkaline; gradual wavy boundary.
2Cg—49 to 60 inches; olive gray (5Y 5/2) silty clay loam; few fine prominent strong brown (7.5YR 4/6) iron concentrations; massive with moderate very fine blocky fragments; firm; few fine soft masses of carbonate; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches
Thickness of the mollic epipedon: 24 to 45 inches

Ap and A horizons:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam

Cg and 2Cg horizons:
Hue—2.5Y or 5Y
Value—3 to 5
Chroma—1 or 2
Texture—silt loam or silty clay loam

Ab horizon:
Hue—5Y or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam or silty clay

418—Lamoure silty clay loam, occasionally flooded

Composition

Lamoure and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Alluvium
Flooding: Occasional
Seasonal high water table: At the surface to 1.5 feet below the surface
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Fargo and similar soils
- Bearden and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Linveldt Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—rapid or moderately rapid; lower part—moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Coarse-loamy, superactive, mixed Aquic Argiborolls

Typical Pedon

Linveldt fine sandy loam, 2,300 feet south and 1,750 feet west of the northeast corner of sec. 28, T. 157 N., R. 45 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; weak fine subangular blocky structure; very friable; few very fine roots; 2 percent gravel; neutral; abrupt smooth boundary.

E—10 to 13 inches; grayish brown (10YR 5/2) loamy sand; few fine distinct dark yellowish brown (10YR 4/4) iron concentrations; weak fine granular structure parting to single grain; very friable; few very fine roots; 2 percent gravel; neutral; clear smooth boundary.

Bt—13 to 19 inches; brown (10YR 4/3) sandy loam; few fine faint dark yellowish brown (10YR 4/4) iron concentrations; weak medium subangular blocky structure; friable; few very fine roots; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds and in pores; 2 percent gravel; neutral; clear smooth boundary.

2Bw1—19 to 23 inches; brown (10YR 5/3) sand; common fine distinct yellowish brown (10YR 5/6) iron concentrations and few fine faint dark grayish brown (10YR 4/2) iron depletions; single grain; loose; 2 percent gravel; slightly alkaline; clear smooth boundary.

2Bw2—23 to 31 inches; light yellowish brown (10YR 6/4) sand; few fine distinct brownish yellow (10YR 6/6) iron concentrations; single grain; loose; 8 percent gravel; slightly effervescent; slightly alkaline; abrupt wavy boundary.

3C—31 to 60 inches; light brownish gray (2.5Y 6/2) loam; few fine prominent dark yellowish brown (10YR 4/6) and common fine prominent brownish yellow (10YR 6/8) iron concentrations; massive with medium blocky soil fragments; friable; few medium masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 15 to 25 inches
Thickness of the mollic epipedon: 7 to 12 inches
Thickness of the sandy mantle: 20 to 40 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—fine sandy loam
Content of rock fragments—2 to 5 percent

E horizon:
Hue—10YR
Value—4 or 5
Chroma—1 or 2
Texture—loamy sand, loamy fine sand, or sandy loam
Content of rock fragments—2 to 5 percent

Bt horizon:
Hue—10YR
Value—4
Chroma—3
Texture—sandy loam, fine sandy loam, or loam
Content of rock fragments—2 to 5 percent

2Bw horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—3 or 4
Texture—sand or loamy fine sand
Content of rock fragments—0 to 35 percent

3C horizon:
Hue—2.5Y
Value—6
Chroma—2
Texture—loam or clay loam
Content of rock fragments—2 to 5 percent

713—Linveldt fine sandy loam

Composition

Linveldt and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.7 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Smiley and similar soils
- Kratka and similar soils
- Reiner and similar soils
- Eckvoll and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Lupton Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow to moderately rapid
Landform: Lake plains
Parent material: Organic materials
Slope range: 0 to 1 percent
Taxonomic classification: Euic Typic Borosaprists

Typical Pedon

Lupton muck, 800 feet north and 1,300 feet east of the southwest corner of sec. 32, T. 157 N., R. 41 W.

Oa1—0 to 12 inches; dark reddish brown (5YR 2/2) muck; 70 percent fiber, 15 percent rubbed; weak coarse granular structure; very friable; 10 percent woody fragments, stems, and sticks; very strongly acid; gradual smooth boundary.
Oe—12 to 21 inches; dark reddish brown (5YR 3/2) mucky peat; 85 percent fiber, 25 percent rubbed; weak coarse subangular blocky structure parting to weak medium granular; very friable; 5 percent woody fragments, stems, and sticks; very strongly acid; gradual smooth boundary.
Oa2—21 to 60 inches; black (5YR 2.5/1) muck; 10 percent fiber, trace rubbed; weak fine and medium subangular blocky structure; very friable; few woody fragments; strongly acid.

Range in Characteristics

Thickness of the histic epipedon: More than 60 inches
Other features: Some pedons have an Oi horizon of living sphagnum material 2 to 4 inches thick.

Oa horizons:
Hue—5YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—muck

Oe horizon:
Hue—5YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—mucky peat

546—Lupton muck

Composition

Lupton and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Available water capacity to 60 inches or root-limiting layer: About 24.0 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Seelyeville and similar soils
- Soils that are ponded
- Cathro and similar soils
- Markey and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Markey Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderately slow to moderately rapid; lower part—rapid
Landform: Lake plains
Parent material: Organic materials and glaciolacustrine deposits
Slope range: 0 to 1 percent
Taxonomic classification: Sandy or sandy-skeletal, mixed, euic Terric Borosaprists

Typical Pedon

Markey muck, 700 feet south and 850 feet east of the northwest corner of sec. 5, T. 154 N., R. 44 W.

Oa—0 to 25 inches; black (10YR 2/1) muck; 25 percent fiber, 10 percent rubbed; weak thin platy structure; very friable; few fine roots; moderately acid; clear smooth boundary.

A—25 to 28 inches; black (2.5Y 2/0) mucky fine sandy loam; weak coarse subangular blocky structure; friable; few fine masses of carbonates; slightly effervescent; neutral; abrupt smooth boundary.

Cg1—28 to 34 inches; light brownish gray (2.5Y 6/2) loamy sand; common fine prominent olive yellow (2.5Y 6/6) iron concentrations; weak medium and coarse subangular blocky structure; very friable; 4 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

Cg2—34 to 60 inches; light brownish gray (2.5Y 6/2) sand; common medium distinct light yellowish brown (2.5Y 6/4) and many fine prominent strong brown (7.5YR 5/6) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 25 to 44 inches
Thickness of the histic epipedon: 16 to 42 inches

Oa horizon:
Hue—10YR or 5YR
Value—2 or 3
Chroma—1 or 2
Texture—muck

A horizon:
Hue—2.5Y, 10YR, or neutral
Value—2
Chroma—0 or 1
Texture—mucky fine sandy loam, mucky sand, fine sandy loam, loamy sand, or sandy loam
Content of rock fragments—0 to 15 percent

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—coarse sand, sand, fine sand, loamy sand, or gravelly sand
Content of rock fragments—0 to 25 percent

543—Markey muck

Composition

Markey and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is

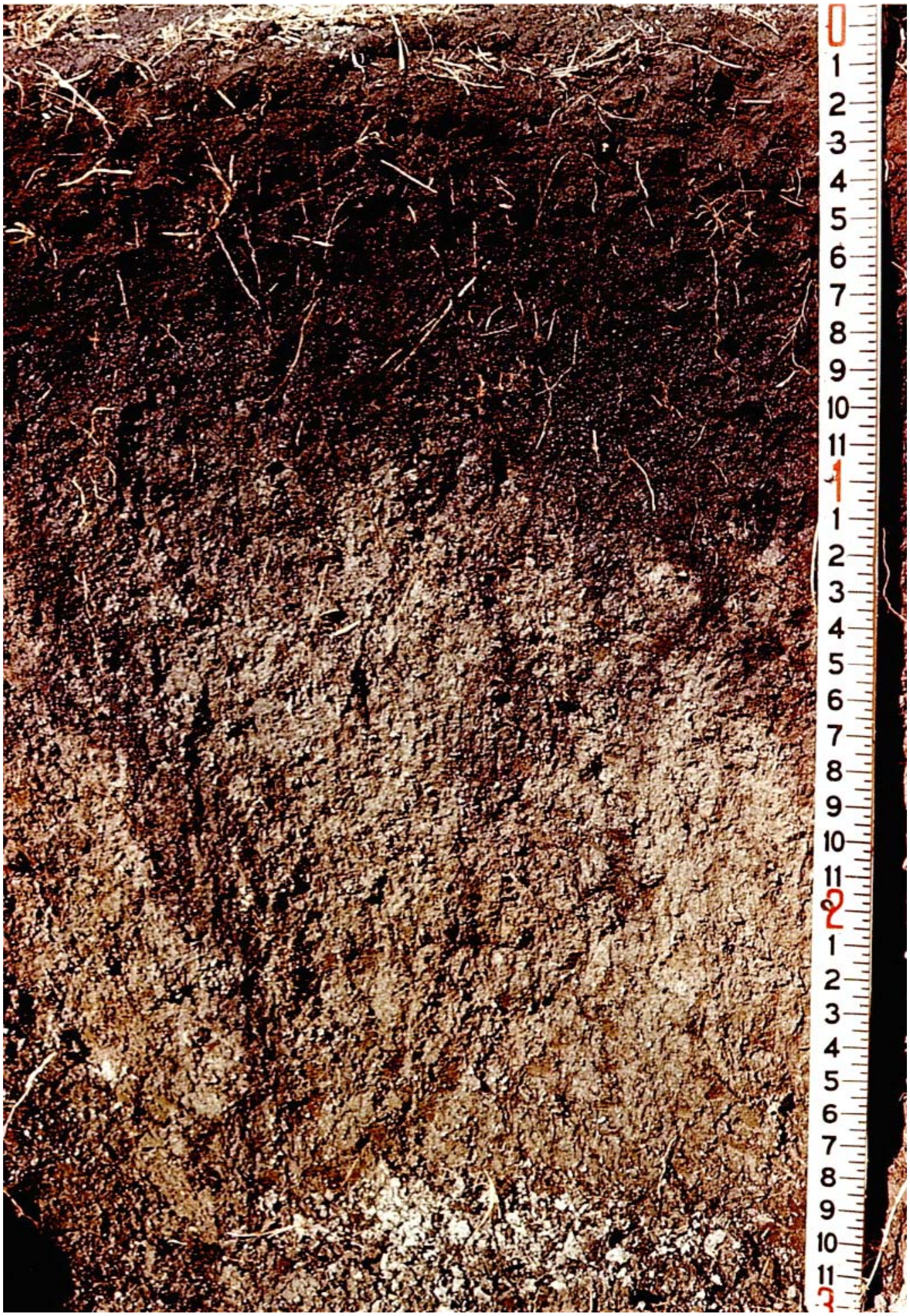

Figure 9.—Typical profile of Fargo silty clay. The dark surface layer extends to a depth of about 12 inches. Depth is marked in inches.

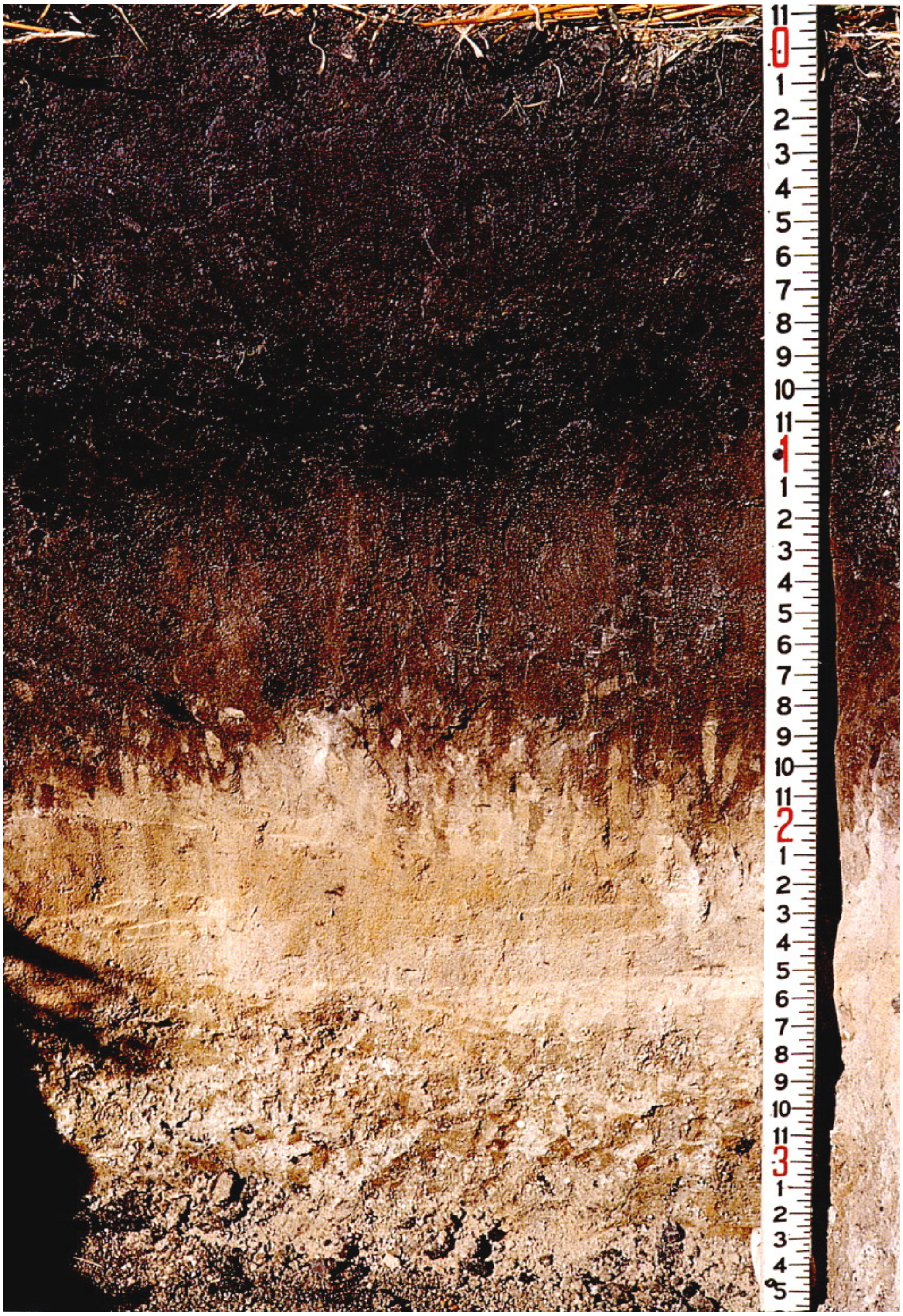

Figure 10.—Typical profile of Strathcona fine sandy loam. A layer of carbonate accumulation extends from a depth of 12 to 31 inches. Depth is marked in inches.

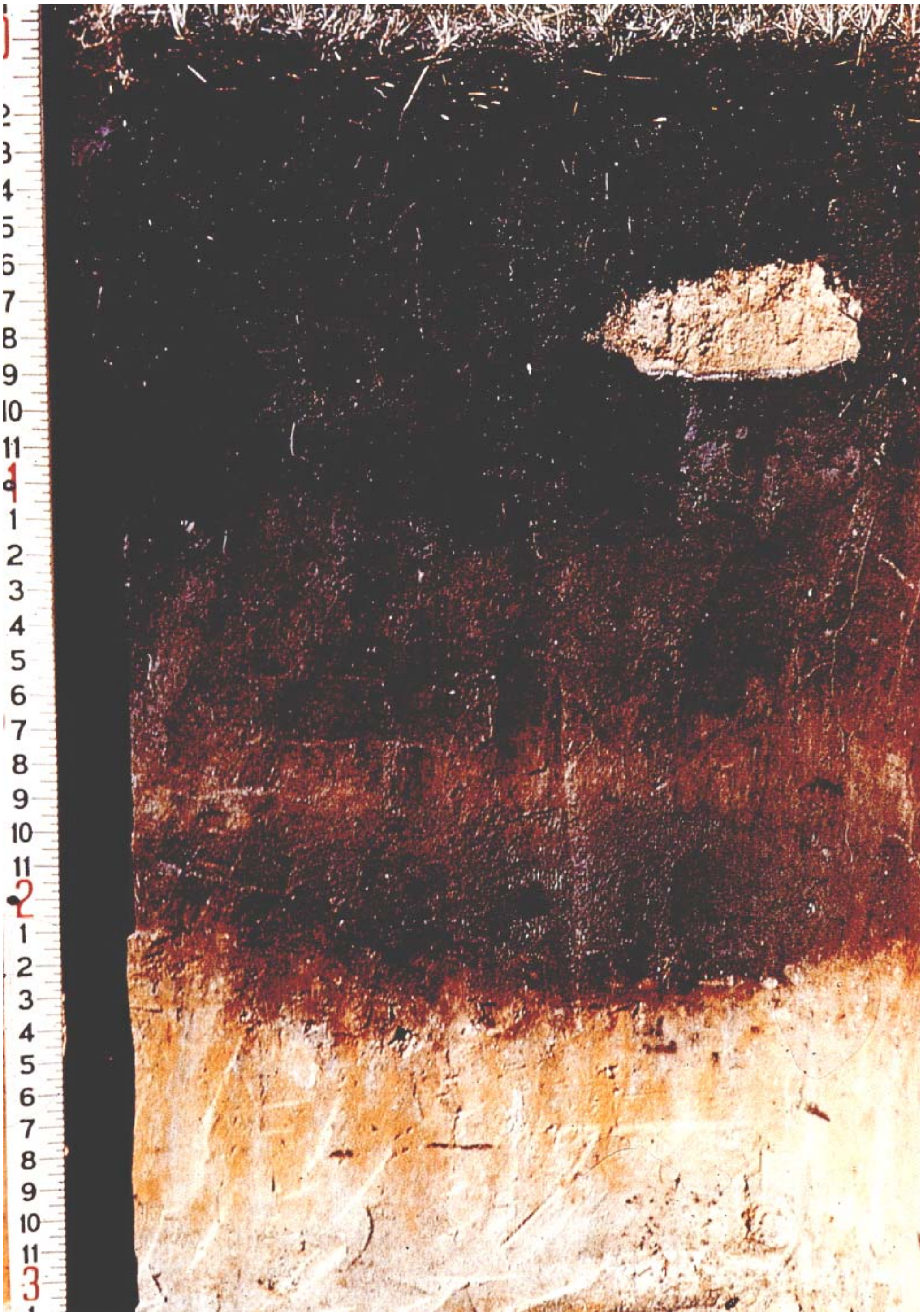
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Figure 11.—Typical profile of Ulen loamy fine sand. A layer of carbonate accumulation extends from a depth of 7 to 26 inches. Depth is marked in inches.

available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Deerwood and similar soils
- Soils that are ponded
- Seelyeville and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1808—Markey muck, ponded

Composition

Markey and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 17.1 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Deerwood and similar soils
- Berner and similar soils
- Seelyeville and similar soils
- Hamre and similar soils
- Soils that have a mineral surface layer

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Marquette Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Upper part—moderately rapid; lower part—very rapid
Landform: Beach ridges on lake plains
Parent material: Beach deposits
Slope range: 1 to 8 percent
Taxonomic classification: Loamy-skeletal, mixed, superactive Ochreptic Eutroboralfs

Typical Pedon

Marquette loamy sand, 1 to 8 percent slopes, 2,600 feet south and 200 feet east of the northwest corner of sec. 31, T. 158 N., R. 42 W.

Ap—0 to 7 inches; black (10YR 2/1) loamy sand, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; very friable; few fine and medium roots; 5 percent gravel; neutral; abrupt smooth boundary.

Bt1—7 to 10 inches; brown (10YR 4/3) sandy loam; moderate fine subangular blocky structure; friable; few fine roots; common distinct dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) clay bridging on sand grains; 10 percent gravel; neutral; clear smooth boundary.

Bt2—10 to 13 inches; dark yellowish brown (10YR 3/4) extremely gravelly sandy loam; moderate fine subangular blocky structure; friable; common fine roots; common distinct dark brown (10YR 3/3) and very dark grayish brown (10YR 3/2) clay bridging on sand grains; 65 percent gravel; neutral; clear smooth boundary.

C1—13 to 29 inches; brown (10YR 5/3) extremely gravelly coarse sand; single grain; loose; few fine roots; 65 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

C2—29 to 60 inches; grayish brown (10YR 5/2) gravelly coarse sand; single grain; loose; 25 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 10 to 24 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand
Content of rock fragments—1 to 5 percent

Bt horizon:
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—3 or 4
Texture—extremely gravelly sandy loam, very gravelly sandy loam, very gravelly loam, very gravelly coarse sandy loam, or sandy loam
Content of rock fragments—averages 35 to 65 percent

C horizon:
Hue—10YR
Value—5 or 6
Chroma—2 or 3
Texture—extremely gravelly coarse sand, very gravelly coarse sand, gravelly coarse sand, very gravelly sand, coarse sand, or sand
Content of rock fragments—10 to 65 percent

242B—Marquette loamy sand, 1 to 8 percent slopes

Composition

Marquette and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Beach ridges
Position on the landform: Summits and backslopes
Slope: 1 to 8 percent

Component Description

Surface layer texture: Loamy sand
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Syrene and similar soils
- Kratka and similar soils
- Sahkahtay and similar soils
- Karlstad and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Mavie Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—rapid; lower part—moderate or moderately slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Sandy-skeletal over loamy, mixed, superactive, frigid Typic Calciaquolls

Typical Pedon

Mavie fine sandy loam, 900 feet north and 200 feet east of the southwest corner of sec. 36, T. 155 N., R. 46 W.

Ap—0 to 10 inches; black (N 2/0) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; 1 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg—10 to 16 inches; grayish brown (2.5Y 5/2) fine sandy loam; common fine and medium distinct gray (5Y 5/1) iron depletions; weak fine subangular blocky structure; very friable; few fine roots; disseminated carbonates; 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2Cg1—16 to 27 inches; light brownish gray (2.5Y 6/2) very gravelly sand; common fine distinct olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; disseminated carbonates; 55 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

3Cg2—27 to 60 inches; grayish brown (2.5Y 5/2) loam; many fine faint light brownish gray (2.5Y 6/2) iron depletions and common medium prominent yellowish brown (10YR 5/6) iron concentrations; massive with medium blocky soil fragments; friable; few fine masses of carbonates; 7 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 12 inches
Thickness of the upper mantle: 20 to 40 inches

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—fine sandy loam
Content of rock fragments—1 to 15 percent

Bkg horizon:
Hue—2.5Y
Value—4 to 6
Chroma—1 or 2
Texture—fine sandy loam, loam, or sandy loam
Content of rock fragments—1 to 15 percent

2Cg horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2
Texture—very gravelly coarse sand, very gravelly sand, or extremely gravelly sand
Content of rock fragments—35 to 65 percent

3Cg horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2
Texture—loam
Content of rock fragments—1 to 8 percent

412—Mavie fine sandy loam

Composition

Mavie and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Foxhome and similar soils
- Roliss and similar soils
- Grimstad and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Nereson Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate or moderately rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Coarse-loamy, mixed, superactive Aquic Argiborolls

Typical Pedon

Nereson fine sandy loam, 2,300 feet south and 50 feet west of the northeast corner of sec. 27, T. 158 N., R. 45 W.

A—0 to 7 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure; friable; many fine roots; neutral; abrupt smooth boundary.
E—7 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam; moderate fine subangular blocky structure; friable; few fine roots; neutral; clear wavy boundary.
Bt—10 to 18 inches; brown (10YR 5/3) loam; moderate medium angular blocky structure; firm;

few very fine roots; few thin dark brown (10YR 3/3) clay films on faces of peds and in pores and some clay bridging between sand grains; 2 percent gravel; neutral; clear smooth boundary.

2Bw—18 to 20 inches; light brownish gray (2.5Y 6/2) gravelly loam; few fine distinct light olive brown (2.5Y 5/4) iron concentrations; moderate medium subangular blocky structure parting to weak fine subangular blocky; friable; few very fine roots; 20 percent gravel; slightly effervescent; moderately alkaline; clear wavy boundary.

2Bkg—20 to 33 inches; light brownish gray (2.5Y 7/2) loam; common fine distinct light yellowish brown (2.5Y 6/4) iron concentrations; moderate medium subangular blocky structure parting to weak fine subangular blocky; friable; few very fine roots; 10 percent gravel; disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.

2Cg—33 to 60 inches; light brownish gray (2.5Y 6/2) loam; many fine distinct light olive brown (2.5Y 5/6) iron concentrations and few medium distinct gray (10YR 5/1) iron depletions; massive breaking to medium blocky soil fragments; friable; 12 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 10 to 22 inches
Thickness of the mollic epipedon: 7 to 14 inches

A horizon:
Hue—10YR
Value—2
Chroma—1
Texture—fine sandy loam
Content of rock fragments—0 to 8 percent

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2
Texture—fine sandy loam
Content of rock fragments—0 to 8 percent

Bt horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—2 or 3
Texture—fine sandy loam, sandy clay loam, loam, or sandy loam
Content of rock fragments—0 to 5 percent

2Bw horizon:
Hue—2.5Y or 10YR
Value—4 to 6
Chroma—2
Texture—gravelly loam, gravelly fine sandy loam, or gravelly sandy loam
Content of rock fragments—15 to 30 percent

2Bkg horizon:
Hue—2.5Y or 10YR
Value—5 to 7
Chroma—2 or 3
Texture—loam, sandy loam, fine sandy loam, gravelly loam, or gravelly sandy loam
Content of rock fragments—10 to 20 percent

2Cg horizon:
Hue—2.5Y
Value—6
Chroma—2
Texture—loam, fine sandy loam, gravelly loam, or gravelly sandy loam
Content of rock fragments—10 to 20 percent

583—Nereson fine sandy loam

Composition

Nereson and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Percy and similar soils
- Enstrom and similar soils
- Foxhome and similar soils

- Skagen and similar soils
- Soils that have a very cobbly surface layer

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Newfolden Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—slow; lower part—moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Fine, mixed over smectitic, superactive Abruptic Udic Argiborolls

Typical Pedon

Newfolden loam, 300 feet south and 2,500 feet west of the northeast corner of sec. 35, T. 155 N., R. 43 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

Bt—7 to 16 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; few fine distinct grayish brown (10YR 5/2) iron depletions; moderate coarse angular blocky structure; firm; common distinct very dark brown (10YR 2/2) clay films on faces of peds and in pores; neutral; clear wavy boundary.

2Bk1—16 to 25 inches; grayish brown (2.5Y 5/2) clay loam; common fine distinct yellowish brown (10YR 5/4) iron concentrations; weak medium subangular blocky structure; friable; many soft masses of carbonates; 3 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk2—25 to 36 inches; light brownish gray (2.5Y 6/2) clay loam; many medium prominent brownish yellow (10YR 6/6) iron concentrations; weak medium subangular blocky structure; friable; many soft masses of carbonates; 3 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

2C—36 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam; many coarse prominent brownish yellow (10YR 6/6) iron concentrations; massive with medium blocky soil fragments; friable; common soft masses of carbonates; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 10 to 29 inches
Thickness of the mollic epipedon: 7 to 18 inches
Other features: Some pedons have a BC horizon.

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—loam
Content of rock fragments—0 to 3 percent

Bt horizon:
Hue—10YR or 2.5Y
Value—2 to 5
Chroma—1 to 3
Texture—clay or clay loam
Content of rock fragments—0 to 5 percent

2Bk or 2Bkg horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—clay loam or loam
Content of rock fragments—2 to 10 percent

2C horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—clay loam or loam
Content of rock fragments—2 to 10 percent

648—Newfolden loam

Composition

Newfolden and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)

Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Boash and similar soils
- Clearwater and similar soils
- Kratka and similar soils
- Roliss and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Northcote Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Very fine, smectitic, frigid Typic Epiaquerts

Typical Pedon

Northcote clay, 0 to 2 percent slopes, 2,300 feet south and 100 feet west of the northeast corner of sec. 1, T. 158 N., R. 49 W.

Ap—0 to 10 inches; black (N 2/0) clay, very dark gray (N 3/0) dry; moderate fine subangular blocky structure; firm; few very fine and fine roots; neutral; abrupt smooth boundary.

Bssg1—10 to 16 inches; dark gray (5Y 4/1) clay; weak coarse prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 45 degrees above the horizontal; cracks 1/4 inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; neutral; clear smooth boundary.

Bssg2—16 to 29 inches; dark gray (5Y 4/1) clay; weak coarse prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bssg3—29 to 49 inches; olive gray (5Y 4/2) clay; common fine faint olive (5Y 4/3) iron concentrations; moderate fine subangular blocky structure; firm; few very fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 to 1 inch wide and 3 to 4 feet apart filled with material from the A horizon; few fine soft masses of carbonates; slightly effervescent; moderately alkaline; gradual smooth boundary.

Cg—49 to 60 inches; olive gray (5Y 4/2) clay; many fine prominent light olive brown (2.5Y 5/6) and common fine faint olive (5Y 4/3) iron concentrations; massive with fine blocky soil fragments; firm; common fine soft masses of carbonates; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 14 to 30 inches
Thickness of the mollic epipedon: 10 to 18 inches
Content of clay: 60 to 80 percent in the 10- to 40-inch control section

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2
Chroma—0 or 1
Texture—clay

Bssg horizon:
Hue—5Y
Value—3 or 4
Chroma—1 or 2
Texture—clay

Cg horizon:
Hue—5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay

429A—Northcote clay, 0 to 2 percent slopes

Composition

Northcote and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Clay
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1 to 3 feet
Available water capacity to 60 inches or root-limiting layer: About 7.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Eaglepoint and similar soils
- Colvin and similar soils
- Fargo and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Northwood Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderately rapid; next part—rapid; lower part—moderate
Landform: Lake plains
Parent material: Organic materials and glaciolacustrine deposits or till
Slope range: 0 to 1 percent
Taxonomic classification: Sandy over loamy, mixed, nonacid, frigid Histic Humaquepts

Typical Pedon

Northwood muck, 1,500 feet north and 1,000 feet east of the southwest corner of sec. 9, T. 157 N., R. 42 W.

Oa—0 to 12 inches; black (10YR 2/1) muck; 20 percent fiber, 10 percent rubbed; weak thin platy structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.

A—12 to 20 inches; black (N 2/0) fine sandy loam; weak fine subangular blocky structure; very friable; few fine roots; neutral; clear wavy boundary.

Bg1—20 to 26 inches; dark grayish brown (2.5Y 4/2) loamy fine sand; few fine prominent brownish yellow (10YR 6/6) iron concentrations; single grain; loose; 1 percent gravel; neutral; clear wavy boundary.

Bg2—26 to 34 inches; light brownish gray (2.5Y 6/2) coarse sand; common medium prominent olive yellow (2.5Y 6/6) iron concentrations; single grain; loose; 12 percent gravel; slightly effervescent; neutral; clear wavy boundary.

2Cg—34 to 60 inches; light brownish gray (2.5Y 6/2) loam; common medium prominent light olive brown (2.5Y 5/6) and few medium prominent dark yellowish brown (10YR 4/6) iron concentrations; massive with medium blocky soil fragments; friable; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 30 inches
Thickness of the histic epipedon: 8 to 16 inches
Depth to glacial till: 20 to 40 inches

Oa horizon:
Hue—10YR
Value—2
Chroma—1 or 2
Texture—muck

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—fine sandy loam, mucky fine sandy loam, or sandy loam
Content of rock fragments—0 to 5 percent

Bg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2

Texture—coarse sand, sand, loamy sand, loamy fine sand, or fine sand
Content of rock fragments—0 to 15 percent

2Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—loam, silty clay loam, or clay loam
Content of rock fragments—2 to 8 percent

563—Northwood muck

Composition

Northwood and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Depth to the water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 11.3 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hamre and similar soils
- Kratka and similar soils
- Markey and similar soils
- Other soils that are ponded

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1146—Northwood muck, ponded

Composition

Northwood and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Seasonal high water table: At the surface to 2 feet above the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 12.7 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a mineral surface layer
- Berner and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Pelan Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—rapid; lower part—moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 3 percent
Taxonomic classification: Loamy-skeletal, mixed, superactive Aquic Argiborolls

Typical Pedon

Pelan sandy loam, 1,500 feet east and 1,450 feet south of the northwest corner of sec. 32, T. 157 N., R. 43 W.

Ap—0 to 6 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; 5 percent gravel; slightly acid; abrupt smooth boundary.

Bt1—6 to 9 inches; brown (10YR 4/3) gravelly coarse sandy loam; moderate medium subangular blocky structure; friable; few fine roots; many very dark grayish brown (10YR 3/2) clay films on faces of peds and bridging sand grains; few fine masses of carbonates; 15 percent gravel; neutral; clear wavy boundary.

Bt2—9 to 12 inches; very dark grayish brown (10YR 3/2) very gravelly sandy loam; weak fine subangular blocky structure; very friable; many dark brown (10YR 3/3) continuous clay films on faces of peds and bridging sand grains; few fine masses of carbonates; 50 percent gravel; slightly alkaline; clear wavy boundary.

Bw1—12 to 16 inches; grayish brown (10YR 5/2) very gravelly coarse sand; single grain; loose; 40 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

Bw2—16 to 24 inches; light brownish gray (2.5Y 6/2) very gravelly coarse sand; few medium distinct light yellowish brown (2.5Y 6/4) iron concentrations; single grain; loose; 40 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

2Bk—24 to 60 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent light olive brown (2.5Y 5/6) and few medium prominent dark yellowish brown (10YR 4/6) iron concentrations; weak fine and medium subangular blocky structure; friable; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 11 to 20 inches
Depth to glacial till: 20 to 40 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—sandy loam
Content of rock fragments—2 to 5 percent

Bt horizon:
Hue—10YR
Value—3 or 4
Chroma—2 or 3
Texture—very gravelly sandy loam, gravelly coarse sandy loam, or gravelly sandy loam
Content of rock fragments—averages 35 to 60 percent

Bw horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2
Texture—very gravelly coarse sand, gravelly sand, or gravelly fine sand
Content of rock fragments—15 to 60 percent

2Bk horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2
Texture—loam
Content of rock fragments—5 to 10 percent

280—Pelan sandy loam

Composition

Pelan and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.6 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Kratka and similar soils
- Smiley and similar soils
- Mavie and similar soils
- Foldahl and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Percy Series

Depth class: Very deep
Drainage class: Poorly drained or very poorly drained
Permeability: Moderate
Landform: Lake plains
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Coarse-loamy, mixed, frigid Typic Calciaquolls

Typical Pedon

Percy loam, 1,200 feet south and 2,100 feet west of the northeast corner of sec. 2, T. 158 N., R. 45 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark brown (10YR 2/2) dry; weak fine granular structure; friable; 3 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

2Bg—8 to 11 inches; dark grayish brown (2.5Y 4/2) gravelly fine sandy loam; common fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak fine and medium subangular blocky structure; friable; 15 percent gravel; 5 percent cobbles; slightly effervescent; slightly alkaline; clear smooth boundary.

2Bkg1—11 to 17 inches; light brownish gray (2.5Y 6/2) loam; common fine distinct light olive brown (2.5Y 5/6) iron concentrations; weak fine and medium subangular blocky structure; friable; disseminated carbonates; 7 percent gravel; 3 percent cobbles; violently effervescent; moderately alkaline; clear wavy boundary.

2Bkg2—17 to 35 inches; grayish brown (2.5Y 5/2) loam; many fine distinct yellowish brown (10YR 5/6) iron concentrations; weak fine and medium subangular blocky structure; friable; many fine carbonate coatings; 10 percent gravel; 3 percent cobbles; strongly effervescent; moderately alkaline; clear smooth boundary.

2Cg—35 to 60 inches; light brownish gray (2.5Y 6/2) loam; many fine distinct yellowish brown (10YR 5/6 and 5/8) iron concentrations; massive; friable; common fine carbonate coatings; 10 percent gravel; 3 percent cobbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 14 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or mucky loam
Content of gravel—0 to 5 percent

2Bg horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—fine sandy loam, loamy fine sand, loamy sand, loam, or the gravelly analogs of these textures
Content of gravel—10 to 30 percent

2Bkg horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—1 or 2
Texture—loam or fine sandy loam
Content of gravel—10 to 13 percent

2Cg horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2
Texture—loam or fine sandy loam
Content of gravel—10 to 13 percent

379—Percy loam, very cobbly

Composition

Percy and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)

Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.7 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Skagen and similar soils
- Haug and similar soils
- Strandquist and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

383—Percy loam

Composition

Percy and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Skagen and similar soils
- Haug and similar soils
- Soils that have a very cobbly surface layer
- Strathcona and similar soils
- Nereson and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

384—Percy mucky loam, depressional

Composition

Percy and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Till
Flooding: None
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 9.7 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Strandquist and similar soils
- Strathcona and similar soils
- Haug and similar soils
- Berner and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1030—Pits, gravel-Udipsamments complex

Composition

Pits: 70 percent
Udipsamments: 20 percent
Inclusions: About 10 percent

Component Description

Pits

Dominant parent material: Beach deposits

Udipsamments

Surface layer texture: Sand
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.0 inches
Organic matter content: Very low

Inclusions

- Marquette and similar soils
- Sandberg and similar soils
- Syrene and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Poppleton Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 3 percent
Taxonomic classification: Mixed, frigid Aquic Udipsamments

Typical Pedon

Poppleton fine sand, 2,600 feet north and 100 feet east of the southwest corner of sec. 23, T. 156 N., R. 47 W.

Ap—0 to 6 inches; very dark gray (10YR 3/1) fine sand, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; very friable; few fine roots; neutral; abrupt smooth boundary.
Bw1—6 to 9 inches; grayish brown (10YR 5/3) fine sand; single grain; loose; few fine roots; neutral; clear wavy boundary.
Bw2—9 to 30 inches; brown (10YR 5/3) fine sand; many fine and medium distinct dark yellowish brown (10YR 4/6) iron concentrations and many medium fine faint grayish brown (10YR 5/2) iron depletions; single grain; loose; slightly acid; clear wavy boundary.
C1—30 to 45 inches; pale brown (10YR 6/3) sand; many medium distinct yellowish brown (10YR 5/6) iron concentrations and few fine faint light brownish gray (10YR 6/2) iron depletions; single grain; loose; slightly effervescent; slightly alkaline; gradual wavy boundary.
C2—45 to 60 inches; light brownish gray (2.5Y 6/2) sand; few fine distinct light yellowish brown (10YR 6/4) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 inches or more
Other features: Some pedons have an E horizon.

A horizon:
Hue—10YR
Value—3
Chroma—1 or 2
Texture—fine sand
Content of rock fragments—0 to 1 percent

Bw horizon:
Hue—10YR
Value—5 or 6
Chroma—3 or 4
Texture—fine sand, sand, or loamy sand

C horizon:
Hue—10YR or 2.5Y
Value—5 to 7
Chroma—2 or 3
Texture—sand or fine sand

148—Poppleton fine sand

Composition

Poppleton and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 4.9 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hamar and similar soils
- Rosewood and similar soils
- Hangaard and similar soils
- Rushlake and similar soils
- Kratka and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Radium Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Beach ridges on lake plains
Parent material: Beach deposits
Slope range: 0 to 3 percent
Taxonomic classification: Sandy, mixed Aquic Haploborolls

Typical Pedon

Radium loamy sand, 1,450 feet south and 500 feet east of the northwest corner of sec. 4, T. 155 N., R. 45 W.

Ap—0 to 14 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; 5 percent gravel; neutral; abrupt smooth boundary.

Bw1—14 to 19 inches; very dark grayish brown (10YR 3/2) sand, grayish brown (10YR 5/2) dry; single grain; loose; few fine roots; 10 percent gravel; neutral; gradual smooth boundary.

Bw2—19 to 33 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; 12 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

C1—33 to 43 inches; dark grayish brown (10YR 4/2) very gravelly coarse sand; few fine faint grayish brown (10YR 5/2) iron depletions; single grain; loose; 50 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C2—43 to 60 inches; light brownish gray (10YR 6/2) sand; single grain; loose; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 10 to 30 inches
Thickness of the mollic epipedon: 10 to 20 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand
Content of rock fragments—0 to 10 percent

Bw horizon:
Hue—10YR
Value—3 or 4
Chroma—1 to 3
Texture—sand, loamy sand, loamy fine sand, or the gravelly analogs of these textures
Content of rock fragments—10 to 25 percent

C horizon:
Hue—10YR or 2.5Y
Value—4 to 7
Chroma—2 to 4
Texture—very gravelly coarse sand, very gravelly sand, gravelly coarse sand, gravelly sand, coarse sand, or sand
Content of rock fragments—averages between 10 and 35 percent; as much as 50 percent in some subhorizons

1874—Radium loamy sand

Composition

Radium and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on beach plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 3.7 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Rosewood and similar soils
- Hangaard and similar soils
- Marquette and similar soils
- Flaming and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Redby Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 3 percent
Taxonomic classification: Mixed, frigid Aquic Udipsamments

Typical Pedon

Redby loamy fine sand, 1,500 feet south and 625 feet east of the northwest corner of sec. 12, T. 158 N., R. 39 W.

Ap—0 to 6 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; very friable; few very fine roots; slightly acid; abrupt smooth boundary.

E—6 to 13 inches; grayish brown (10YR 5/2) fine sand; common fine prominent dark yellowish brown (10YR 4/6) and few fine prominent dark brown (7.5YR 4/4) iron concentrations; single grain; loose; slightly acid; clear wavy boundary.

Bw1—13 to 21 inches; brown (10YR 5/3) fine sand; few medium prominent red (2.5YR 4/6), few fine distinct dark brown (7.5YR 4/4), and common fine distinct dark yellowish brown (10YR 4/6) iron concentrations; single grain; loose; neutral; gradual wavy boundary.

Bw2—21 to 36 inches; brown (10YR 5/3) fine sand; few fine prominent yellowish red (5YR 4/6), few fine distinct dark brown (7.5YR 4/4), and many medium distinct brownish yellow (10YR 6/6) iron concentrations and few fine distinct gray (10Y 5/1) iron depletions; single grain; loose; neutral; gradual wavy boundary.

C—36 to 60 inches; light brownish gray (2.5Y 6/2) fine sand; few fine prominent olive yellow (2.5Y 6/6) iron concentrations and few fine distinct gray (10Y 5/1) iron depletions; single grain; loose; 2 percent gravel; slightly effervescent; neutral.

Range in Characteristics

Depth to carbonates: 36 inches or more

A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—loamy fine sand

E horizon:
Hue—10YR
Value—5 or 6
Chroma—2 or 3
Texture—fine sand or sand

Bw horizon:
Hue—10YR
Value—4 to 6
Chroma—3 or 4
Texture—fine sand or sand

C horizon:
Hue—10YR or 2.5Y

Value—5 to 7
Chroma—2 or 3
Texture—fine sand or sand
Content of rock fragments—0 to 2 percent

116—Redby loamy fine sand

Composition

Redby and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 1.5 to 2.5 feet
Available water capacity to 60 inches or root-limiting layer: About 4.8 inches
Organic matter content: Moderately low

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Cormant and similar soils
- Clearriver and similar soils
- Grygla and similar soils
- Strathcona and similar soils
- Eckvoll and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Reiner Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Till
Slope range: 0 to 3 percent
Taxonomic classification: Fine-loamy, mixed, superactive Abruptic Udic Argiborolls

Typical Pedon

Reiner fine sandy loam, 1,900 feet north and 1,700 feet east of the southwest corner of sec. 6, T. 155 N., R. 40 W.

Ap—0 to 9 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; common very fine roots; neutral; abrupt smooth boundary.

Bt—9 to 16 inches; brown (10YR 4/3) clay loam; few medium distinct dark grayish brown (2.5Y 4/2) iron depletions; moderate fine subangular blocky structure; firm; few very fine roots; common very dark grayish brown (2.5Y 3/2) clay films on faces of peds; neutral; clear smooth boundary.

Bk—16 to 32 inches; light brownish gray (2.5Y 6/2) loam; common medium distinct light yellowish brown (10YR 6/4) and few medium prominent brownish yellow (10YR 6/6) iron concentrations; weak medium subangular blocky structure; friable; common fine soft masses of carbonates; 2 percent cobbles; strongly effervescent; slightly alkaline; gradual smooth boundary.

C—32 to 60 inches; light brownish gray (2.5Y 6/2) loam; few medium prominent light olive brown (2.5Y 5/6) and common medium distinct pale yellow (2.5Y 7/4) iron concentrations; massive with medium blocky soil fragments; friable; many fine soft masses of carbonates; 3 percent cobbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 13 to 22 inches
Thickness of the mollic epipedon: 7 to 16 inches
Other features: Some pedons have an E horizon.

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—fine sandy loam or loamy fine sand

Bt horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—2 to 4
Texture—clay loam, sandy clay loam, or loam
Content of rock fragments—0 to 5 percent

Bk horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam or clay loam
Content of rock fragments—1 to 8 percent

C horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—loam or clay loam
Content of rock fragments—1 to 8 percent

649—Reiner loamy fine sand

Composition

Reiner and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Kratka and similar soils
- Roliss and similar soils
- Smiley and similar soils
- Eckvoll and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

650—Reiner fine sandy loam

Composition

Reiner and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.5 to 5.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Smiley and similar soils
- Kratka and similar soils
- Roliss and similar soils
- Pelan and similar soils
- Linveldt and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Reis Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate to slow
Landform: Lake plains
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Fine, smectitic, frigid Typic Calciaquerts

Typical Pedon

Reis clay loam, in an area of Clearwater-Reis complex, 275 feet south and 2,350 feet west of the northeast corner of sec. 31, T. 156 N., R. 42 W.

Ap—0 to 7 inches; black (N 2/0) clay loam, very dark gray (5Y 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; few fine carbonate coatings on faces of peds; 1 percent gravel; violently effervescent; moderately alkaline; abrupt wavy boundary.

Bkssg1—7 to 14 inches; olive gray (5Y 4/2) silty clay; common fine prominent light olive brown (2.5Y 5/6) iron concentrations; moderate fine angular blocky structure; firm; common fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 45 degrees above the horizontal; cracks 1/4 inch to 3 inches wide and 2 to 4 feet apart filled with material from the A horizon; common fine carbonate coatings on faces of peds; 2 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bkssg2—14 to 21 inches; olive gray (5Y 5/2) silty clay; many fine prominent dark olive brown (2.5Y 5/4) iron concentrations; moderate fine subangular blocky structure; firm; few fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 inch to 2 inches wide and 2 to 4 feet apart filled with material from the A horizon; few fine carbonate coatings on faces of peds; 2 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

Bkssg3—21 to 30 inches; olive gray (5Y 5/2) clay; many medium prominent olive brown (2.5Y 4/4) iron concentrations; moderate medium angular blocky structure; firm; few fine roots; few distinct intersecting slickensides on faces of peds with a slant of less than 60 degrees above the horizontal; cracks 1/4 to 1 inch wide and 3 to 4 feet apart filled with material from the A horizon; common soft masses of carbonates; 2 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

Cg—30 to 60 inches; dark greenish gray (5GY 4/1) clay; common medium prominent olive brown (2.5Y 4/4) iron concentrations; massive with medium blocky soil fragments; firm; common soft masses of carbonates; 3 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—clay loam
Content of rock fragments—1 to 4 percent

Bkssg horizon:
Hue—2.5Y or 5Y
Value—3 to 5
Chroma—1 or 2
Texture—silty clay or clay
Content of rock fragments—2 to 8 percent

Cg horizon:
Hue—2.5Y, 5Y, or 5GY
Value—4 or 5
Chroma—1 or 2
Texture—clay or silty clay
Content of rock fragments—2 to 8 percent

Rifle Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately rapid
Landform: Lake plains
Parent material: Organic materials
Slope range: 0 to 1 percent
Taxonomic classification: Euic Typic Borohemists

Typical Pedon

Rifle mucky peat, 700 feet north and 150 feet west of the southeast corner of sec. 4, T. 157 N., R. 39 W.

Oe1—0 to 6 inches; black (10YR 2/1) mucky peat; 70 percent fiber, 30 percent rubbed; weak thick platy structure; very friable; common very fine and fine roots; very strongly acid; clear smooth boundary.

Oe2—6 to 30 inches; very dark brown (10YR 2/2) mucky peat; 80 percent fiber, 40 percent rubbed; weak thin platy structure; very friable; common very fine roots; extremely acid; clear smooth boundary.

Oa—30 to 35 inches; black (10YR 2/1) muck; 40 percent fiber, 10 percent rubbed; weak thin platy structure; very friable; few very fine roots; strongly acid; clear smooth boundary.

O′e—35 to 60 inches; very dark brown (10YR 2/2) mucky peat; 60 percent fiber, 25 percent rubbed; massive; very friable; few very fine roots; very strongly acid.

Range in Characteristics

Thickness of the histic epipedon: Greater than 60 inches

Oe and O′e horizons:
Hue—10YR, 7.5YR, or 5YR
Value—2 or 3
Chroma—1 to 4
Texture—mucky peat

Oa horizon:
Hue—10YR
Value—2
Chroma—1
Texture—muck

541—Rifle mucky peat

Composition

Rifle and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Mucky peat
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 31.8 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Tacoosh and similar soils
- Berner and similar soils
- Soils that contain more wood fragments
- Soils that are ponded

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Roliss Series

Depth class: Very deep
Drainage class: Poorly drained and very poorly drained
Permeability: Moderately slow or moderate
Landform: Lake plains
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy, mixed, superactive, calcareous, frigid Typic Endoaquolls

Typical Pedon

Roliss loam, 300 feet south and 2,050 feet west of the northeast corner of sec. 24, T. 155 N., R. 45 W.

Ap—0 to 9 inches; black (N 2/0) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; few fine roots; 2 percent gravel; neutral; abrupt smooth boundary.

A—9 to 12 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine roots; 2 percent gravel; very slightly effervescent; slightly alkaline; clear wavy boundary.

Bg—12 to 17 inches; dark grayish brown (2.5Y 4/2) loam; few fine distinct dark yellowish brown (10YR 4/4) iron concentrations; weak fine subangular blocky structure; friable; few fine roots; 3 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

Bkg—17 to 26 inches; grayish brown (2.5Y 5/2) loam; many medium distinct light yellowish brown (2.5Y 6/4) and common fine prominent olive yellow (2.5Y 6/6) iron concentrations; weak fine subangular blocky structure; friable; many fine soft masses of carbonates; 7 percent gravel; strongly effervescent; slightly alkaline; gradual wavy boundary.

BC—26 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium distinct light olive brown (2.5Y 5/6) iron concentrations and common medium faint light gray (2.5Y 7/2) iron depletions; weak fine subangular blocky structure; friable; many fine soft masses of carbonates; 7 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches
Thickness of the mollic epipedon: 7 to 14 inches

Ap horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—loam
Content of rock fragments—0 to 2 percent

Bg horizon:
Hue—2.5Y or 5Y
Value—3 to 5
Chroma—1 or 2
Texture—loam, fine sandy loam, or clay loam
Content of rock fragments—0 to 3 percent

Bkg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2
Texture—loam or clay loam
Content of rock fragments—1 to 10 percent

BC horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam, silty clay loam, or clay loam
Content of rock fragments—1 to 10 percent

387—Roliss loam, depressional

Composition

Roliss and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Till
Flooding: None
Seasonal high water table: 0.5 foot above to 1.5 feet below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Strathcona and similar soils
- Hamre and similar soils
- Vallers and similar soils
- Berner and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

582—Roliss loam

Composition

Roliss and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hamre and similar soils
- Kratka and similar soils
- Kittson and similar soils
- Smiley and similar soils
- Mavie and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

972—Roliss-Vallers complex

Composition

Roliss and similar soils: About 50 percent
Vallers and similar soils: About 40 percent
Inclusions: About 10 percent

Setting

Landform: Roliss—flats and swales on lake plains; Vallers—slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Roliss

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches
Organic matter content: High

Vallers

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.2 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hamre and similar soils
- Hamerly and similar soils
- Kratka and similar soils
- Kittson and similar soils
- Smiley and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Rosewood Series

Depth class: Very deep
Drainage class: Poorly drained or very poorly drained
Permeability: Upper part—moderately rapid; lower part—rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Sandy, mixed, frigid Typic Calciaquolls

Typical Pedon

Rosewood fine sandy loam, 1,200 feet east and 300 feet south of the northwest corner of sec. 12, T. 157 N., R. 47 W.

Ap—0 to 12 inches; black (10YR 2/1) fine sandy loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; very friable; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—12 to 18 inches; dark gray (10YR 4/1) loamy fine sand; common medium faint grayish brown (2.5Y 5/2) iron depletions; weak fine subangular blocky structure; very friable; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg2—18 to 22 inches; grayish brown (2.5Y 5/2) loamy fine sand; common medium faint dark grayish brown (2.5Y 4/2) iron depletions and common fine prominent dark yellowish brown (10YR 4/6) iron concentrations; weak fine subangular blocky structure; very friable; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Cg—22 to 60 inches; light brownish gray (2.5Y 6/2) fine sand; common medium distinct light yellowish brown (2.5Y 6/4) and many medium prominent light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 14 inches

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—fine sandy loam

Bkg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—loamy fine sand, fine sand, or fine sandy loam

Cg horizon:
Hue—2.5Y or 5Y
Value—5 to 7
Chroma—2
Texture—fine sand or sand

712—Rosewood fine sandy loam

Composition

Rosewood and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 5.6 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Flaming and similar soils
- Deerwood and similar soils
- Strathcona and similar soils
- Northwood and similar soils
- Syrene and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1882—Rosewood, Strathcona, and Berner soils, seepy

Composition

Rosewood: Variable
Strathcona: Variable
Berner: Variable
Inclusions: About 10 percent

Setting

Landform: Toeslopes
Slope: Rosewood—0 to 2 percent; Strathcona—0 to 2 percent; Berner—0 to 1 percent

Component Description

Rosewood

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Available water capacity to 60 inches or root-limiting layer: About 5.9 inches

Organic matter content: High

Strathcona

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Seasonal high water table: At the surface to 0.5 foot below the surface
Available water capacity to 60 inches or root-limiting layer: About 8.5 inches
Organic matter content: High

Berner

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Seasonal high water table: At the surface to 0.5 foot below the surface
Available water capacity to 60 inches or root-limiting layer: About 14.3 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Karlstad and similar soils
- Radium and similar soils
- Sandberg and similar soils
- Deerwood and similar soils
- Seelyeville and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1966—Rosewood-Hamar complex

Composition

Rosewood and similar soils: About 55 percent
Hamar and similar soils: About 40 percent
Inclusions: About 5 percent

Setting

Landform: Rosewood—flats and slight rises on lake plains; Hamar—swales on lake plains
Slope: 0 to 2 percent

Component Description

Rosewood

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 5.3 inches
Organic matter content: High

Hamar

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Seasonal high water table: At the surface to 1.5 feet below the surface
Available water capacity to 60 inches or root-limiting layer: About 4.8 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Ulen and similar soils
- Strathcona and similar soils
- Northwood and similar soils
- Deerwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Rushlake Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Beach ridges on lake plains
Parent material: Beach deposits
Slope range: 0 to 3 percent
Taxonomic classification: Mixed, frigid Aquic Udipsamments

Typical Pedon

Rushlake loamy sand, 550 feet south and 2,150 feet east of the northwest corner of sec. 7, T. 157 N., R. 43 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loamy sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.

Bw—8 to 12 inches; dark brown (10YR 4/3) loamy sand, dark yellowish brown (10YR 4/4) dry; weak medium subangular blocky structure; loose; 1 percent gravel; neutral; abrupt smooth boundary.

C1—12 to 17 inches; dark grayish brown (10YR 4/2) gravelly loamy sand; single grain; loose; 23 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

C2—17 to 24 inches; dark grayish brown (10YR 4/2) gravelly sand; single grain; loose; 21 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

C3—24 to 42 inches; grayish brown (10YR 5/2) gravelly sand; common medium distinct light yellowish brown (2.5Y 6/4) and few fine distinct yellowish brown (10YR 5/6) iron concentrations and few fine distinct gray (10YR 5/1) iron depletions; single grain; loose; 17 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

C4—42 to 60 inches; light brownish gray (10YR 6/2) sand; common medium distinct light yellowish brown (2.5Y 6/4) and few fine distinct yellowish brown (10YR 5/6) iron concentrations and few fine distinct gray (10YR 5/1) iron depletions; single grain; loose; 7 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 11 to 36 inches
Thickness of the surface layer: 4 to 9 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand
Content of rock fragments—0 to 8 percent

Bw horizon:
Hue—10YR
Value—4
Chroma—3
Texture—loamy sand or sand
Content of rock fragments—1 to 10 percent

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—gravelly loamy sand, gravelly sand, gravelly coarse sand, coarse sand, sand, or loamy coarse sand
Content of rock fragments—5 to 35 percent

708—Rushlake loamy sand

Composition

Rushlake and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on beach plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 4.0 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Deerwood and similar soils
- Syrene and similar soils
- Rosewood and similar soils
- Marquette and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Sahkahtay Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—moderate; lower part—rapid or very rapid
Landform: Beach deposits on lake plains
Parent material: Beach deposits
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid Mollic Endoaqualfs

Typical Pedon

Sahkahtay sandy loam, 100 feet south and 1,200 feet west of the northeast corner of sec. 2, T. 157 N., R. 43 W.

A—0 to 4 inches; black (10YR 2/1) sandy loam, very dark gray (10YR 3/1) dry; weak medium granular structure; friable; common very fine roots; neutral; abrupt smooth boundary.

E—4 to 8 inches; dark grayish brown (10YR 4/2) loamy sand, light brownish gray (10YR 6/2) dry; few fine faint brown (10YR 5/3) iron concentrations; weak fine subangular blocky structure; loose; few very fine roots; 5 percent gravel; neutral; clear wavy boundary.

Btg—8 to 14 inches; dark grayish brown (10YR 4/2) sandy clay loam; common fine distinct yellowish brown (10YR 5/6) iron concentrations and common fine distinct gray (2.5Y 5/1) iron depletions; moderate fine angular blocky structure; firm; few fine roots; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; 5 percent gravel; neutral; gradual smooth boundary.

Cg1—14 to 18 inches; dark grayish brown (2.5Y 4/2) loamy coarse sand; few fine faint olive brown (2.5Y 4/4) iron concentrations and common fine distinct gray (2.5Y 5/1) iron depletions; weak fine subangular blocky soil fragments parting to single grain; very friable; few very fine roots; 10 percent gravel; slightly alkaline; gradual smooth boundary.

Cg2—18 to 30 inches; dark grayish brown (2.5Y 4/2) gravelly coarse sand; few fine distinct light olive brown (2.5Y 5/6) iron concentrations and few fine distinct gray (2.5Y 5/1) iron depletions; single grain; loose; 30 percent gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.

Cg3—30 to 60 inches; grayish brown (2.5Y 5/2) gravelly coarse sand; few fine distinct light olive brown (2.5Y 5/6) iron concentrations and few fine distinct gray (2.5Y 5/1) iron depletions; single grain; loose; 30 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 14 to 30 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—sandy loam
Content of rock fragments—0 to 15 percent

E horizon:
Hue—10YR
Value—4 to 6
Chroma—2
Texture—loamy sand or sand
Content of rock fragments—2 to 7 percent

Btg horizon:
Hue—10YR or 2.5Y
Value—4
Chroma—2
Texture—sandy clay loam or sandy loam
Content of rock fragments—2 to 5 percent

Cg horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 or 3
Texture—gravelly coarse sand, gravelly sand, loamy coarse sand, or sand
Content of rock fragments—averages 10 to 35 percent; less than 10 percent or more than 35 percent in some subhorizons

1191—Sahkahtay sandy loam

Composition

Sahkahtay and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on beach plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 3.7 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Karlstad and similar soils
- Clearriver and similar soils
- Deerwood and similar soils
- Soils that have a till substratum

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Sandberg Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Upper part—rapid; lower part—very rapid
Landform: Beach ridges on lake plains
Parent material: Beach deposits
Slope range: 1 to 6 percent
Taxonomic classification: Sandy, mixed Udorthentic Haploborolls

Typical Pedon

Sandberg loamy sand, 1 to 6 percent slopes, 1,250 feet north and 300 feet east of the southwest corner of sec. 30, T. 155 N., R. 44 W.

Ap—0 to 12 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; few fine roots; 5 percent gravel; neutral; abrupt smooth boundary.

Bw—12 to 17 inches; very dark brown (10YR 3/3) sand, dark yellowish brown (10YR 4/4) dry; single grain; loose; few fine roots; 10 percent gravel; slightly acid; clear wavy boundary.

C1—17 to 26 inches; brown (10YR 5/3) coarse sand; single grain; loose; few fine roots; 12 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

C2—26 to 39 inches; brown (10YR 5/3) very gravelly coarse sand; single grain; loose; 50 percent gravel; strongly effervescent; slightly alkaline; clear smooth boundary.

C3—39 to 60 inches; dark grayish brown (10YR 4/2) coarse sand; single grain; loose; 10 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 13 to 20 inches
Thickness of the mollic epipedon: 9 to 16 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy sand
Content of rock fragments—2 to 10 percent

Bw horizon:
Hue—10YR
Value—3 or 4
Chroma—3
Texture—sand or gravelly sand
Content of rock fragments—5 to 35 percent

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 or 3
Texture—very gravelly coarse sand, gravelly coarse sand, coarse sand, or sand
Content of rock fragments—5 to 35 percent; as much as 55 percent in some subhorizons

258B—Sandberg loamy sand, 1 to 6 percent slopes

Composition

Sandberg and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Beach ridges
Position on the landform: Summits and backslopes
Slope: 1 to 6 percent

Component Description

Surface layer texture: Loamy sand
Depth class: Very deep (more than 60 inches)
Drainage class: Excessively drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.2 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Radium and similar soils
- Syrene and similar soils
- Soils that contain more gravel
- Hangaard and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Seelyeville Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow to moderately rapid
Landform: Lake plains
Parent material: Organic materials
Slope range: 0 to 1 percent
Taxonomic classification: Euic Typic Borosaprists

Typical Pedon

Seelyeville muck, 2,300 feet south and 2,100 feet west of the northeast corner of sec. 13, T. 157 N., R. 46 W.

Oa—0 to 8 inches; black (10YR 2/1) muck; 30 percent fiber, 5 percent rubbed; weak fine granular structure; very friable; common very fine and fine roots; slightly acid; clear smooth boundary.

Oe—8 to 12 inches; very dark grayish brown (10YR 3/2) mucky peat; 40 percent fiber, 25 percent rubbed; weak thick platy structure; very friable; few very fine roots; moderately acid; clear smooth boundary.

O′a1—12 to 26 inches; black (10YR 2/1) muck; 25 percent fiber, 5 percent rubbed; weak thin platy structure; very friable; few very fine and fine roots; moderately acid; gradual wavy boundary.

O′a2—26 to 40 inches; black (10YR 2/1) muck; 20 percent fiber, 5 percent rubbed; weak fine subangular blocky structure; very friable; few very fine and fine roots; moderately acid; gradual wavy boundary.

O′a3—40 to 60 inches; black (10YR 2/1) muck; 15 percent fiber, trace rubbed; massive; very friable; few very fine and fine roots; moderately acid.

Range in Characteristics

Thickness of the histic epipedon: More than 60 inches

Oa horizon:
Hue—10YR or 7.5YR
Value—2 or 3
Chroma—1
Texture—muck

Oe horizon:
Hue—10YR
Value—3
Chroma—2
Texture—mucky peat

540—Seelyeville muck

Composition

Seelyeville and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials
Flooding: None

Seasonal high water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 24.0 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Berner and similar soils
- Soils that are ponded
- Rifle and similar soils
- Lupton and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1031—Seelyeville muck, ponded

Composition

Seelyeville and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials
Flooding: None
Seasonal high water table: At the surface to 3 feet above the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 24.0 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Cathro and similar soils
- Soils that have a mineral surface layer
- Soils that contain woody fragments
- Berner and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Skagen Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Till
Slope range: 0 to 3 percent
Taxonomic classification: Coarse-loamy, mixed, superactive, frigid Aquic Calciborolls

Typical Pedon

Skagen loam, 1,900 feet north and 900 feet west of the southeast corner of sec. 10, T. 157 N., R. 45 W.

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark grayish brown (2.5Y 3/2) dry; moderate medium subangular blocky structure parting to moderate fine granular; friable; few fine carbonate concretions; 2 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—7 to 10 inches; grayish brown (2.5Y 5/2) gravelly loam; weak fine and medium subangular blocky structure; very friable; disseminated carbonates; 11 percent gravel; 4 percent cobbles; violently effervescent; moderately alkaline; clear smooth boundary.

2Bk2—10 to 14 inches; light brownish gray (2.5Y 6/2) loam; weak fine and medium subangular blocky structure; very friable; disseminated carbonates; 8 percent gravel; 4 percent cobbles; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk3—14 to 21 inches; light yellowish brown (2.5Y 6/4) loam; common fine and medium faint olive yellow (2.5Y 6/6) iron concentrations; weak fine and medium subangular blocky structure; very

friable; disseminated carbonates; 6 percent gravel; 4 percent cobbles; violently effervescent; moderately alkaline; clear smooth boundary.
2Bw—21 to 60 inches; light yellowish brown (2.5Y 6/4) loam; common fine faint olive yellow (2.5Y 6/8) iron concentrations; weak fine and medium subangular blocky structure; very friable; 6 percent gravel; 4 percent cobbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 10 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam
Content of rock fragments—2 to 5 percent gravel; 0 to 10 percent cobbles

Bk horizon:
Hue—2.5Y
Value—5
Chroma—2
Texture—gravelly loam or gravelly fine sandy loam
Content of rock fragments—15 to 35 percent gravel; 0 to 10 percent cobbles

2Bk horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—1 to 4
Texture—loam, clay loam, sandy loam, fine sandy loam, or the gravelly analogs of these textures
Content of rock fragments—5 to 15 percent gravel; 0 to 5 percent cobbles

2Bw horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—loam, fine sandy loam, or the gravelly analogs of these textures
Content of rock fragments—5 to 15 percent gravel; 0 to 5 percent cobbles

1158—Skagen loam

Composition

Skagen and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.8 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Percy and similar soils
- Strathcona and similar soils
- Radium and similar soils
- Foxhome and similar soils
- Soils that have a very cobbly surface layer

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1170—Skagen loam, very cobbly

Composition

Skagen and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Till

Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.8 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Percy and similar soils
- Foxhome and similar soils
- Strandquist and similar soils
- Strathcona and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Smiley Series

Depth class: Very deep
Drainage class: Poorly drained or very poorly drained
Permeability: Moderately slow or moderate
Landform: Lake plains
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy, mixed, superactive, frigid Typic Argiaquolls

Typical Pedon

Smiley loam, 200 feet north and 200 feet east of the southwest corner of sec. 28, T. 156 N., R. 39 W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure parting to moderate fine granular; friable; common fine and few medium roots; 2 percent gravel; neutral; abrupt smooth boundary.

Btg—9 to 16 inches; very dark gray (5Y 3/1) clay loam; moderate medium subangular blocky structure; friable; common fine and few medium roots; common distinct black (5Y 2.5/1) clay films on faces of peds; 2 percent gravel; neutral; gradual wavy boundary.

Bkg1—16 to 20 inches; olive gray (5Y 5/2) loam; common medium faint olive (5Y 5/3) iron concentrations; weak fine subangular blocky structure; friable; few fine roots; disseminated carbonates; 4 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

Bkg2—20 to 38 inches; olive gray (5Y 5/2) loam; many fine and medium prominent olive yellow (2.5Y 6/6) iron concentrations and many medium faint grayish brown (2.5Y 5/2) iron depletions; weak coarse subangular blocky structure; friable; common soft masses of carbonates; 7 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

Cg—38 to 60 inches; light olive gray (5Y 6/2) loam; many medium prominent olive yellow (2.5Y 6/6) iron concentrations and few fine distinct dark gray (5Y 4/1) iron depletions; massive with coarse blocky soil fragments; friable; common soft masses of carbonates; 7 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 11 to 20 inches
Thickness of the mollic epipedon: 7 to 16 inches

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 to 2
Texture—loam or mucky loam
Content of rock fragments—2 to 5 percent

Btg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 5
Chroma—1 or 2
Texture—clay loam, silty clay loam, or loam
Content of rock fragments—2 to 5 percent

Bkg horizon:
Hue—2.5Y or 5Y
Value—4 to 7
Chroma—2 to 4
Texture—loam or clay loam
Content of rock fragments—2 to 7 percent

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—loam or clay loam
Content of rock fragments—2 to 7 percent

653—Smiley mucky loam, depressional

Composition

Smiley and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 10.0 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Vallers and similar soils
- Kratka and similar soils
- Hamre and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

765—Smiley loam

Composition

Smiley and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Reiner and similar soils
- Kratka and similar soils
- Vallers and similar soils
- Hamre and similar soils
- Northwood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Strandquist Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—rapid; lower part—moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Sandy-skeletal over loamy, mixed, superactive, calcareous, frigid Typic Endoaquolls

Typical Pedon

Strandquist loam, 950 feet north and 300 feet east of the southwest corner of sec. 10, T. 156 N., R. 39 W.

Ap—0 to 10 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; common very fine roots; slightly alkaline; abrupt smooth boundary.

2Bg1—10 to 15 inches; dark grayish brown (2.5Y 4/2) very gravelly loamy coarse sand; few fine prominent light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; common very fine roots; 55 percent gravel; slightly effervescent; slightly alkaline; clear wavy boundary.

2Bg2—15 to 30 inches; grayish brown (2.5Y 5/2) very gravelly coarse sand; common fine prominent brownish yellow (10YR 6/6) iron concentrations; single grain; loose; few very fine roots; 50 percent gravel; slightly effervescent; slightly alkaline; abrupt wavy boundary.

3Bg3—30 to 36 inches; grayish brown (2.5Y 5/2) loam; common fine distinct light yellowish brown (2.5Y 6/4) iron concentrations; weak fine subangular blocky structure; friable; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline; gradual smooth boundary.

3Cg—36 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium prominent light olive brown (2.5Y 5/6) iron concentrations; massive with fine blocky soil fragments; friable; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches
Thickness of the mollic epipedon: 7 to 12 inches
Depth to glacial till: 20 to 40 inches

A horizon:
Hue—10YR
Value—2
Chroma—1
Texture—loam
Content of rock fragments—0 to 10 percent

2Bg horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2
Texture—very gravelly coarse sand, very gravelly sand, gravelly coarse sand, gravelly sand, or very gravelly loamy coarse sand
Content of rock fragments—averages 35 to 75 percent

3Bg and 3Cg horizons:
Hue—2.5Y
Value—5 or 6
Chroma—2
Texture—loam
Content of rock fragments—3 to 10 percent

432—Strandquist loam

Composition

Strandquist and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.1 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Foxhome and similar soils
- Karlstad and similar soils
- Roliss and similar soils
- Northwood and similar soils
- Hangaard and similar soils
- Percy and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Strathcona Series

Depth class: Very deep
Drainage class: Poorly drained and very poorly drained

Permeability: Upper part—moderately rapid or rapid; lower part—moderate
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Sandy over loamy, mixed, superactive, frigid Typic Calciaquolls

Typical Pedon

Strathcona fine sandy loam (fig. 10), 1,650 feet south and 400 feet west of the northeast corner of sec. 2, T. 156 N., R. 44 W.

Ap—0 to 9 inches; black (N 2/0) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg—9 to 15 inches; dark gray (10YR 4/1) fine sandy loam; weak fine subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

2Bg1—15 to 21 inches; light brownish gray (2.5Y 6/2) fine sand; common coarse prominent brownish yellow (10YR 6/8) and few fine prominent strong brown (7.5YR 5/6) iron concentrations; single grain; loose; strongly effervescent; slightly alkaline; clear wavy boundary.

2Bg2—21 to 32 inches; light brownish gray (2.5Y 6/2) fine sand; common medium prominent olive yellow (2.5Y 6/6) and few fine prominent strong brown (7.5YR 5/6) iron concentrations; single grain; loose; strongly effervescent; moderately alkaline; clear wavy boundary.

3Cg—32 to 60 inches; grayish brown (2.5Y 5/2) loam; common medium prominent yellowish brown (10YR 5/8) iron concentrations and many fine faint light brownish gray (10YR 6/2) iron depletions; massive with medium blocky soil fragments; friable; few fine threads and soft masses of carbonates; 6 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches
Thickness of the sandy mantle: 20 to 40 inches

A horizon:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—fine sandy loam or mucky fine sandy loam

Bkg horizon:
Hue—10YR or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—fine sandy loam, loamy fine sand, or fine sand

2Bg horizon:
Hue—2.5Y or 5Y
Value—5 to 7
Chroma—2
Texture—fine sand, loamy sand, or loamy fine sand

3Cg horizon:
Hue—2.5Y or 5Y
Value—5 to 7
Chroma—1 or 2
Texture—loam
Content of rock fragments—2 to 7 percent

439—Strathcona fine sandy loam

Composition

Strathcona and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Northwood and similar soils
- Grimstad and similar soils
- Vallers and similar soils

- Rosewood and similar soils
- Mavie and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1144—Strathcona and Kratka soils, depressional

Composition

Strathcona: Variable
Kratka: Variable
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Strathcona

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 9.2 inches
Organic matter content: Very high

Kratka

Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 8.0 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Northwood and similar soils
- Roliss and similar soils
- Percy and similar soils
- Deerwood and similar soils
- Hamre and similar soils
- Rosewood and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Syrene Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—moderately rapid; lower part—rapid
Landform: Beach deposits on lake plains
Parent material: Beach deposits
Slope range: 0 to 2 percent
Taxonomic classification: Sandy, mixed, frigid Typic Calciaquolls

Typical Pedon

Syrene sandy loam, 200 feet south and 1,250 feet west of the northeast corner of sec. 9, T. 156 N., R. 46 W.

Ap—0 to 10 inches; black (N 2/0) sandy loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; few fine roots; 1 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg—10 to 19 inches; dark gray (5Y 4/1) fine sandy loam; common medium distinct dark grayish brown (2.5Y 4/2) and common fine faint gray (5Y 5/1) iron depletions; weak medium subangular blocky structure; very friable; few fine roots; disseminated carbonates; 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2Cg1—19 to 25 inches; light brownish gray (2.5Y 6/2) fine sand; few fine prominent light olive brown

(2.5Y 5/6) iron concentrations; single grain; loose; 5 percent gravel; slightly effervescent; slightly alkaline; gradual wavy boundary.

2Cg2—25 to 60 inches; light brownish gray (2.5Y 6/2) gravelly fine sand; many medium distinct light yellowish brown (2.5Y 6/4) and many fine and medium prominent yellowish brown (10YR 5/6) iron concentrations; single grain; loose; 30 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 12 inches

A horizon:
Hue—10YR or neutral
Value—2
Chroma—0 or 1
Texture—sandy loam
Content of rock fragments—0 to 10 percent

Bkg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—fine sandy loam, very fine sandy loam, or loam
Content of rock fragments—0 to 15 percent

2Cg horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—gravelly sand, gravelly fine sand, coarse sand, sand, or fine sand
Content of rock fragments—5 to 35 percent

435—Syrene sandy loam

Composition

Syrene and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on beach plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Beach deposits
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 4.3 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Radium and similar soils
- Grimstad and similar soils
- Mavie and similar soils
- Deerwood and similar soils
- Northwood and similar soils
- Rosewood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Tacoosh Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Upper part—moderate or moderately rapid; lower part—moderately slow or moderate
Landform: Lake plains
Parent material: Organic materials and till
Slope range: 0 to 1 percent
Taxonomic classification: Loamy, mixed, euic Terric Borohemists

Typical Pedon

Tacoosh muck, 100 feet north and 1,500 feet east of the southwest corner of sec. 4, T. 158 N., R. 40 W.

Oa—0 to 8 inches; black (10YR 2/1) muck; 70 percent fiber, 15 percent rubbed; weak thick platy structure parting to weak thin platy; very friable; very strongly acid; clear smooth boundary.

Oe1—8 to 21 inches; black (10YR 2/1) mucky peat; 90 percent fiber, 35 percent rubbed; weak thick platy structure parting to weak thin platy; friable; strongly acid; clear smooth boundary.

Oe2—21 to 29 inches; dark brown (7.5YR 3/2) mucky peat; 90 percent fiber, 35 percent rubbed; weak medium and coarse subangular blocky structure; friable; extremely acid; clear smooth boundary.

Oe3—29 to 33 inches; black (10YR 2/1) mucky peat; 70 percent fiber, 20 percent rubbed; weak medium and coarse subangular blocky structure; very friable; extremely acid; clear smooth boundary.

O′a—33 to 36 inches; black (10YR 2/1) muck; 40 percent fiber, 10 percent rubbed; weak fine and medium subangular blocky structure; very friable; extremely acid; abrupt smooth boundary.

Cg1—36 to 40 inches; dark grayish brown (10YR 4/2) sandy loam; massive with fine blocky soil fragments; friable; common medium black (10YR 2/1) organic coatings on exteriors of blocky soil fragments; 10 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

Cg2—40 to 60 inches; very dark gray (10YR 4/1) fine sandy loam; few fine distinct dark yellowish brown (10YR 4/6) iron concentrations; massive with medium blocky soil fragments; friable; few fine black (10YR 2/1) organic coatings on exteriors of blocky soil fragments; 3 percent gravel; violently effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: 30 to 51 inches
Thickness of the histic epipedon: 16 to 50 inches

Oa horizon:
Hue—10YR
Value—2
Chroma—1
Texture—muck

Oe horizon:
Hue—10YR or 7.5YR
Value—2 or 3
Chroma—1 or 2
Texture—mucky peat

Cg horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 or 2
Texture—fine sandy loam, sandy loam, or loam
Content of rock fragments—2 to 10 percent

514—Tacoosh muck

Composition

Tacoosh and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 18.9 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Rifle and similar soils
- Hamre and similar soils
- Northwood and similar soils
- Seelyeville and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Thiefriver Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—moderately rapid; lower part—slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Sandy over clayey, mixed over smectitic, frigid Typic Calciaquolls

Typical Pedon

Thiefriver fine sandy loam, 2,000 feet south and 750 feet east of the northwest corner of sec. 9, T. 156 N., R. 42 W.

Ap—0 to 8 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; very friable; few fine roots; 3 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—8 to 15 inches; grayish brown (2.5Y 5/2) loamy fine sand; few fine prominent yellowish brown (10YR 5/8) iron concentrations; weak medium subangular blocky structure; friable; few fine roots; disseminated carbonates; 2 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg2—15 to 31 inches; light brownish gray (2.5Y 6/2) loamy fine sand; common fine prominent olive yellow (2.5Y 6/6) iron concentrations; weak medium subangular blocky structure; very friable; disseminated carbonates; 1 percent gravel; strongly effervescent; slightly alkaline; abrupt wavy boundary.

2Cg—31 to 60 inches; dark gray (5Y 4/1) clay; few fine prominent light olive brown (2.5Y 5/6) and common fine prominent olive brown (2.5Y 4/4) iron concentrations; massive with fine blocky soil fragments; very firm; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 11 inches
Thickness of the sandy mantle: 20 to 40 inches

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—2
Chroma—0 or 1
Texture—fine sandy loam
Content of rock fragments—1 to 5 percent

Bkg horizon:
Hue—2.5Y
Value—4 to 7
Chroma—1 or 2
Texture—loamy fine sand or fine sandy loam
Content of rock fragments—1 to 5 percent

2Cg horizon:
Hue—5Y
Value—4
Chroma—1 or 2
Texture—clay
Content of rock fragments—1 to 5 percent

651—Thiefriver fine sandy loam

Composition

Thiefriver and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 7.6 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Huot and similar soils
- Clearwater and similar soils
- Hilaire and similar soils
- Espelie and similar soils
- Rosewood and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Ulen Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Rapid
Landform: Lake plains
Parent material: Glaciolacustrine deposits

Slope range: 0 to 3 percent
Taxonomic classification: Sandy, frigid, mixed Aeric Calciaquolls

Typical Pedon

Ulen loamy fine sand (fig. 11), 750 feet north and 1,900 feet west of the southeast corner of sec. 23, T. 156 N., R. 47 W.

Ap—0 to 10 inches; black (10YR 2/1) loamy fine sand, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—10 to 17 inches; dark gray (10YR 4/1) loamy fine sand; weak medium subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—17 to 21 inches; dark grayish brown (10YR 4/2) loamy fine sand; weak medium subangular blocky structure; very friable; few fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear smooth boundary.

C1—21 to 27 inches; light yellowish brown (2.5Y 6/4) fine sand; few fine distinct light brownish gray (10YR 6/2) iron depletions; single grain; loose; slightly effervescent; slightly alkaline; clear smooth boundary.

C2—27 to 49 inches; light brownish gray (2.5Y 6/2) fine sand; common medium prominent olive yellow (2.5Y 6/6) and common fine prominent yellowish brown (10YR 5/8) iron concentrations; single grain; loose; slightly effervescent; slightly alkaline; gradual wavy boundary.

C3—49 to 60 inches; light brownish gray (2.5Y 6/2) very fine sand; many medium prominent olive yellow (2.5Y 6/6) and common fine prominent light olive brown (2.5Y 5/6) iron concentrations and gray (10YR 5/1) iron depletions; single grain; loose; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 16 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy fine sand

Bk horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 to 4
Texture—loamy fine sand, loamy sand, or fine sandy loam

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 6
Texture—fine sand or loamy fine sand; subhorizons of very fine sand, sand, or coarse sand in some pedons

1264—Ulen loamy fine sand

Composition

Ulen and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Slight rises on lake plains
Slope: 0 to 3 percent

Component Description

Surface layer texture: Loamy fine sand
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 4.8 inches
Organic matter content: Moderate

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Rosewood and similar soils
- Huot and similar soils
- Radium and similar soils
- Strathcona and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Vallers Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Lake plains
Parent material: Till
Slope range: 0 to 2 percent
Taxonomic classification: Fine-loamy, mixed, superactive, frigid Typic Calciaquolls

Typical Pedon

Vallers loam, 1,000 feet south and 800 feet east of the northwest corner of sec. 11, T. 156 N., R. 44 W.

Ap—0 to 9 inches; black (N 2/0) loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; common very fine roots; 2 percent gravel; slightly effervescent; neutral; abrupt smooth boundary.

Bkg1—9 to 15 inches; light brownish gray (2.5Y 6/2) loam; few fine distinct gray (2.5Y 5/1) iron depletions and common fine distinct light olive brown (2.5Y 5/4) iron concentrations; weak very fine subangular blocky structure; friable; few very fine roots; disseminated carbonates; 1 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

Bkg2—15 to 26 inches; light brownish gray (2.5Y 6/2) loam; common medium distinct light yellowish brown (2.5Y 6/4) and few fine distinct light olive brown (2.5Y 5/4) iron concentrations; weak fine subangular blocky structure; friable; few very fine roots; few fine soft masses of carbonates; 4 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

Cg—26 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium distinct light yellowish brown (2.5Y 6/4) and common fine distinct light olive brown (2.5Y 5/4) iron concentrations; massive with fine blocky soil fragments; friable; few fine soft masses of carbonates; 6 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 12 inches

A horizon:
Hue—10YR, 5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—loam
Content of rock fragments—0 to 8 percent

Bkg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 6
Chroma—1 or 2
Texture—loam, silty clay loam, or sandy clay loam
Content of rock fragments—1 to 5 percent

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—2
Texture—loam or clay loam
Content of rock fragments—2 to 8 percent

236—Vallers loam

Composition

Vallers and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Till
Flooding: None
Depth to the water table: 0.5 foot to 1.5 feet
Available water capacity to 60 inches or root-limiting layer: About 11.2 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Northwood and similar soils
- Kratka and similar soils
- Mavie and similar soils
- Grimstad and similar soils
- Hamre and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Wahpeton Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow or moderate
Landform: River terraces
Parent material: Alluvium
Slope range: 0 to 6 percent
Taxonomic classification: Fine, smectitic, frigid Typic Hapluderts

Typical Pedon

Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded, 800 feet north and 1,800 feet west of the southeast corner of sec. 8, T. 157 N., R. 50 W.

Ap—0 to 9 inches; very dark gray (5Y 3/1) silty clay, dark gray (5Y 4/1) dry; strong fine and medium angular blocky structure; very firm; slightly alkaline; clear smooth boundary.
Ass—9 to 22 inches; very dark grayish brown (2.5Y 3/2) silty clay, dark gray (5Y 4/1) dry; strong fine and medium angular blocky structure; very firm; common distinct slickensides on faces of peds; slightly alkaline; clear smooth boundary.
Bss—22 to 35 inches; dark olive gray (5Y 3/2) silty clay, gray (5Y 5/1) dry; moderate thin and medium platy structure; very firm; common distinct slickensides; slightly alkaline; clear smooth boundary.
C—35 to 60 inches; dark olive gray (5Y 3/2) silty clay, light gray (5Y 6/1) dry; massive with medium platy soil fragments; very firm; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 11 to 35 inches
Thickness of the mollic epipedon: 18 to 38 inches
Other features: An Ab horizon in some pedons; a Bk horizon in some pedons

A and Ass horizons:
Hue—10YR, 2.5Y, or 5Y
Value—2 or 3
Chroma—1 or 2
Texture—silty clay

Bss and C horizons:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 5
Chroma—1 or 2
Texture—silty clay, silty clay loam, or clay

157A—Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded

Composition

Wahpeton and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Flooding: Occasional
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Fargo and similar soils
- Northcote and similar soils
- Colvin and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

157B—Wahpeton silty clay, 2 to 6 percent slopes, occasionally flooded

Composition

Wahpeton and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Rises on flood plains and terraces

Slope: 2 to 6 percent

Component Description

Surface layer texture: Silty clay
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Alluvium
Flooding: Occasional
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 9.2 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Fargo and similar soils
- Northcote and similar soils
- Colvin and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Wheatville Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Upper part—moderately rapid; lower part—slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits
Slope range: 0 to 2 percent
Taxonomic classification: Coarse-silty over clayey, mixed over smectitic, superactive, frigid Aeric Calciaquolls

Typical Pedon

Wheatville very fine sandy loam, 0 to 2 percent slopes, 1,500 feet north and 300 feet east of the southwest corner of sec. 33, T. 157 N., R. 47 W.

Ap—0 to 9 inches; black (10YR 2/1) very fine sandy loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; very friable; few very fine roots; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 14 inches; dark gray (10YR 4/1) very fine sandy loam; weak fine subangular blocky structure; very friable; few very fine roots; disseminated carbonates; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—14 to 23 inches; light yellowish brown (2.5Y 6/4) loamy very fine sand; weak fine and medium subangular blocky structure; very friable; few very fine roots; strongly effervescent; slightly alkaline; gradual wavy boundary.

Bw—23 to 29 inches; light yellowish brown (2.5Y 6/4) loamy very fine sand; common medium prominent olive gray (5Y 5/2) iron depletions and common medium distinct light olive brown (2.5Y 5/6) iron concentrations; weak fine and medium subangular blocky structure; very friable; few very fine roots; slightly effervescent; slightly alkaline; abrupt wavy boundary.

2C—29 to 60 inches; dark grayish brown (2.5Y 4/2) clay; common fine faint grayish brown (2.5Y 5/2) iron depletions and common fine prominent yellowish brown (10YR 5/6) iron concentrations; massive with medium and fine blocky soil fragments; very firm; few soft masses of carbonates; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 14 inches
Thickness of the silty mantle: 20 to 40 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—very fine sandy loam

Bk horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 to 4
Texture—loamy very fine sand or very fine sandy loam

Bw horizon:
Hue—2.5Y
Value—5 or 6
Chroma—4
Texture—loamy very fine sand, very fine sandy loam, or very fine sand

2C horizon:
Hue—2.5Y

Value—4 to 6
Chroma—2
Texture—clay, silty clay, silty clay loam, or clay loam

1315A—Wheatville very fine sandy loam, 0 to 2 percent slopes

Composition

Wheatville and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Very fine sandy loam
Depth class: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Dominant parent material: Glaciolacustrine deposits
Flooding: None
Depth to the water table: 2.5 to 3.5 feet
Available water capacity to 60 inches or root-limiting layer: About 8.9 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Augsburg and similar soils
- Clearwater and similar soils
- Ulen and similar soils
- Grimstad and similar soils
- Thiefriver and similar soils

Major Uses of the Unit

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Wildwood Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Slow
Landform: Lake plains
Parent material: Organic materials and glaciolacustrine deposits or till
Slope range: 0 to 1 percent
Taxonomic classification: Very fine, smectitic, nonacid, frigid Histic Humaquepts

Typical Pedon

Wildwood muck, 1,300 feet north and 175 feet west of the southeast corner of sec. 5, T. 155 N., R. 42 W.

Oa—0 to 9 inches; black (N 2/0) muck; 15 percent fiber rubbed; weak medium subangular blocky structure parting to weak fine granular; very friable; few very fine roots; strongly acid; abrupt smooth boundary.

A—9 to 12 inches; black (N 2/0) silty clay loam; few fine prominent dark brown (7.5YR 3/4) iron concentrations; weak fine subangular blocky structure; friable; few very fine roots; 3 percent gravel; neutral; clear wavy boundary.

Bg—12 to 18 inches; dark gray (5Y 4/1) clay; few fine prominent dark yellowish brown (10YR 4/6) iron concentrations and common fine distinct light olive gray (5Y 6/2) iron depletions; weak medium subangular blocky structure; firm; 3 percent gravel; slightly effervescent; neutral; clear wavy boundary.

Bkg—18 to 29 inches; olive gray (5Y 5/2) silty clay; few fine prominent light olive brown (2.5Y 5/6) iron concentrations and common fine faint dark gray (5Y 4/1) iron depletions; weak medium subangular blocky structure; firm; common fine soft masses of carbonates; 4 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

Cg—29 to 60 inches; olive gray (5Y 5/1) silty clay; few fine prominent light olive brown (2.5Y 5/6) iron concentrations and common fine faint dark gray (5Y 4/1) iron depletions; massive with medium blocky soil fragments; firm; few fine soft masses of carbonates; 3 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 12 to 19 inches
Thickness of the histic epipedon: 8 to 16 inches

Oa horizon:
Hue—5Y or neutral
Value—2
Chroma—0 or 1
Texture—muck

A horizon:
Hue—10YR or neutral

Value—2
Chroma—0 or 1
Texture—silty clay loam or silty clay
Content of rock fragments—2 to 3 percent

Bg and Bkg horizons:
Hue—5Y, 2.5Y, or 10YR
Value—3 to 5
Chroma—1 or 2
Texture—clay or silty clay
Content of rock fragments—2 to 4 percent

Cg horizon:
Hue—5Y, 2.5Y, or 10YR
Value—3 to 5
Chroma—1 or 2
Texture—silty clay, clay, or clay loam
Content of rock fragments—2 to 4 percent

630—Wildwood muck

Composition

Wildwood and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 4.6 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Thiefriver and similar soils
- Dora and similar soils
- Soils that are ponded
- Reis and similar soils

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

1188—Wildwood muck, ponded

Composition

Wildwood and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Depressions on lake plains
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth class: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Dominant parent material: Organic materials and glaciolacustrine deposits or till
Flooding: None
Seasonal high water table: At the surface to 2 feet above the surface
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 6.5 inches
Organic matter content: Very high

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Dora and similar soils
- Soils that have a mineral surface layer

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Wyandotte Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Upper part—moderate; next part—rapid; lower part—slow
Landform: Lake plains
Parent material: Glaciolacustrine deposits and till
Slope range: 0 to 2 percent
Taxonomic classification: Sandy-skeletal over clayey, mixed over smectitic, frigid Typic Calciaquolls

Typical Pedon

Wyandotte clay loam, 300 feet east and 300 feet south of the northwest corner of sec. 12, T. 154 N., R. 44 W.

Ap—0 to 8 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; few fine roots; 2 percent gravel; strongly effervescent; slightly alkaline; abrupt smooth boundary.

Bkg1—8 to 15 inches; dark gray (10YR 4/1) loam; weak medium subangular blocky structure; friable; few fine roots; disseminated carbonates; 2 percent gravel; violently effervescent; moderately alkaline; clear wavy boundary.

2Bkg2—15 to 29 inches; grayish brown (2.5Y 5/2) very gravelly coarse sand; few medium prominent light olive brown (2.5Y 5/6) iron concentrations; single grain; loose; few fine roots; 60 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

3Cg—29 to 60 inches; olive gray (5Y 4/2) clay; common medium distinct olive (5Y 5/4) iron concentrations; weak medium subangular blocky structure; firm; few very fine roots; common fine soft masses of carbonates; 5 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 12 inches
Depth to clayey lacustrine sediments: 20 to 40 inches

A horizon:
Hue—10YR
Value—2
Chroma—1
Texture—clay loam
Content of rock fragments—2 to 5 percent

Bkg horizon:
Hue—10YR
Value—4
Chroma—1
Texture—loam
Content of rock fragments—2 to 5 percent

2Bkg horizon:
Hue—2.5Y
Value—5 or 6
Chroma—2
Texture—very gravelly coarse sand or very gravelly sand
Content of rock fragments—35 to 60 percent

3Cg horizon:
Hue—5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay or silty clay
Content of rock fragments—3 to 5 percent

652—Wyandotte clay loam

Composition

Wyandotte and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and slight rises on lake plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Clay loam
Depth class: Very deep (more than 60 inches)
Drainage class: Poorly drained
Dominant parent material: Glaciolacustrine deposits and till
Flooding: None
Depth to the water table: 1 to 3 feet
Available water capacity to 60 inches or root-limiting layer: About 6.0 inches
Organic matter content: High

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Foxhome and similar soils
- Hilaire and similar soils
- Clearwater and similar soils
- Espelie and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Aspect. The direction in which a slope faces.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes. Backslopes in profile are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Channery soil material. Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the surface after planting in order to reduce the hazard of water erosion; in areas where wind erosion is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or its equivalent during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. The thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have an intermediate or high water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of most field crops are affected. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted under natural conditions. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poor drainage is caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except for rice) under natural conditions.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. The term is more often applied to cliffs resulting from differential erosion.

Esker. A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is generally a constructional landform consisting of sediment deposited during overflow and lateral migration of the stream.

Footslope. The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface is dominantly concave. In terms of gradational processes, a footslope is a transition zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Geomorphology. The science that treats the general configuration of the earth's surface; specifically the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and the history of geologic changes as recorded by these surface features. The term is especially applied to the genetic interpretation of landforms.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-chroma zones. Zones having chroma of 3 or more. Typical color in areas of iron concentrations.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 6 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Ice-walled lake plain. A relict surface marking the floor of an extinct lake basin that was formed on solid ground and surrounded by stagnant ice in a stable or unstable superglacial environment on stagnation moraines. As the ice melted, the lake plain became perched above the adjacent landscape. The lake plain is well sorted, generally fine textured, stratified deposits.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Iron concentrations. High-chroma zones having a high content of iron and manganese oxide because of chemical oxidation and accumulation, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic concentration.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame. An irregular, short ridge or hill of stratified glacial drift.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake bed. The bottom of a lake; a lake basin.

Lake plain. A nearly level surface marking the floor of an extinct lake filled by well-sorted, generally fine-textured, stratified deposits, commonly containing varves.

Lakeshore. A narrow strip of land in contact with or bordering a lake; especially the beach of a lake.

Lake terrace. A narrow shelf, partly cut and partly built, produced along a lake shore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches

(7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low-chroma zones. Zones having chroma of 2 or less. Typical color in areas of iron depletions.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of glacial drift in a topographic landform resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Extremely slow	less than 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	less than 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables). Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The hillslope position that forms the uppermost inclined surface near the top of a hillslope. It comprises the transition zone from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of rock fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter or loosen a layer that restricts roots.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summit. The topographically highest position of a hillslope profile and exhibiting a nearly level surface. A general term for the top, or highest level of a landform, such as a hill, mountain, or tableland. It usually refers to a high interfluve area of gentler slope that is flanked by steeper hillslopes, for example, mountain fronts or tableland escarpments.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Swale. A slight depression in the midst of generally level land. A shallow depression in an undulating ground moraine due to uneven glacial deposition.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Till plain. An extensive area of nearly level to undulating or gently sloping soils that are underlain by till or consist of till. Slopes are 0 to 6 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as salts, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with the
Minnesota Agricultural
Experiment Station

Soil Survey of Marshall County, Minnesota

Part II

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How to Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, the survey area is divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** in Part I of this survey for a general description of the soils in your area.

The **detailed soil maps** can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet, and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** in Part I of this survey, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** in Part II shows which table has data on a specific land use for each detailed soil map unit. See the **Contents** in Part I and Part II for other sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in November 1992. Soil names and descriptions were approved in September 1994. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1992. This survey was made cooperatively by the Natural Resources Conservation Service and the Minnesota Agricultural Experiment Station. Assistance was provided by the Agriculture Extension Service, Minnesota Department of Natural Resources, and the Board of Water and Soil Resources. The survey was partially funded by the Legislative Commission for Minnesota Resources and by Marshall County. It is part of the technical assistance furnished to the Marshall County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

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Cover: Several conservation practices are visible on this farmstead east of Argyle in Marshall County. Field windbreaks and conservation tillage reduce the hazard of soil blowing in an area of the Wheatville-Glyndon association. Crop rotations help to control erosion and maintain soil fertility.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov (click on "Technical Resources").

Contents

How to Use This Soil Survey 3
Index to Map Units 6
Tables:
Classification of the Soils 10
Acreage and Proportionate Extent of the Soils 12
Agronomy 15
Soil Salinity 17
Cropland Management Considerations 18
Crop Yield Estimates 19
Land Capability Classification 19
Prime Farmland 20
Erosion Factors 21
Windbreaks and Environmental Plantings 22
Tables:
Cropland Management Considerations 24
Land Capability and Yields per Acre of Crops and Pasture 36
Prime Farmland 44
Windbreaks and Environmental Plantings 45
Windbreak Suitability Groups 56
Forest Land 61
Tables:
Forest Land Harvest Equipment Considerations 63
Forest Haul Road Considerations 63
Forest Log Landing Considerations 64
Forest Land Site Preparation and Planting Considerations 64
Recreation 65
Table:
Recreational Development 68
Wildlife Habitat 77
Table:
Wildlife Habitat 79
Engineering 85
Building Site Development 85
Sanitary Facilities 86
Waste Management 87
Construction Materials 88
Water Management 89
Tables:
Building Site Development 91
Sanitary Facilities 101
Construction Materials 112
Water Management 121
Soil Properties 135
Engineering Index Properties 135
Physical and Chemical Properties 136
Water Features 138
Soil Features 139
Tables:
Engineering Index Properties 141
Physical Properties of the Soils 161
Chemical Properties of the Soils 171
Water Features 181
Soil Features 187
References 193
Glossary 195

Issued 2000

Index to Map Units

47—Colvin silty clay loam
57A—Fargo silty clay, 0 to 2 percent slopes
58—Kittson loam
59—Grimstad fine sandy loam
65—Foxhome sandy loam
66—Flaming loamy fine sand
67A—Bearden silt loam, 0 to 2 percent slopes
67B—Bearden silt loam, 2 to 6 percent slopes
77—Garnes fine sandy loam
93A—Bearden silty clay loam, 0 to 2 percent slopes
111—Hangaard sandy loam
116—Redby loamy fine sand
117—Cormant loamy fine sand
145—Enstrom loamy fine sand
148—Poppleton fine sand
157A—Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded
157B—Wahpeton silty clay, 2 to 6 percent slopes, occasionally flooded
184A—Hamerly loam, 0 to 3 percent slopes
187—Haug muck
205—Karlstad loamy sand
236—Vallers loam
242B—Marquette loamy sand, 1 to 8 percent slopes
258B—Sandberg loamy sand, 1 to 6 percent slopes
280—Pelan sandy loam
372—Hamar loamy fine sand
379—Percy loam, very cobbly
383—Percy loam
384—Percy mucky loam, depressional
387—Roliss loam, depressional
412—Mavie fine sandy loam
418—Lamoure silty clay loam, occasionally flooded
426—Foldahl loamy fine sand
429A—Northcote clay, 0 to 2 percent slopes
432—Strandquist loam
435—Syrene sandy loam
439—Strathcona fine sandy loam
481—Kratka fine sandy loam
482—Grygla loamy fine sand
514—Tacoosh muck
540—Seelyeville muck
541—Rifle mucky peat
543—Markey muck
544—Cathro muck
546—Lupton muck
547—Deerwood muck
550—Dora muck
563—Northwood muck
565—Eckvoll loamy fine sand
582—Roliss loam
583—Nereson fine sandy loam
630—Wildwood muck
641—Clearwater clay
642—Clearwater loam
643—Huot fine sandy loam
644—Boash clay loam
645—Espelie fine sandy loam
647—Hilaire loamy fine sand
648—Newfolden loam
649—Reiner loamy fine sand
650—Reiner fine sandy loam
651—Thiefriver fine sandy loam
652—Wyandotte clay loam
653—Smiley mucky loam, depressional
708—Rushlake loamy sand
712—Rosewood fine sandy loam
713—Linveldt fine sandy loam
721B—Corliss loamy sand, 1 to 6 percent slopes
765—Smiley loam
794—Clearriver loamy fine sand
935—Hegne-Fargo complex
936—Clearwater-Reis complex
937—Eaglepoint-Northcote complex
972—Roliss-Vallers complex
1006—Fluvaquents-Haploborolls complex, 0 to 30 percent slopes, flooded
1030—Pits, gravel-Udipsamments complex
1031—Seelyeville muck, ponded
1143—Berner-Markey complex
1144—Strathcona and Kratka soils, depressional
1146—Northwood muck, ponded
1158—Skagen loam
1170—Skagen loam, very cobbly
1187—Dora muck, ponded
1188—Wildwood muck, ponded
1189—Clearwater mucky loam, depressional
1191—Sahkahtay sandy loam
1264—Ulen loamy fine sand
1297—Augsburg very fine sandy loam

1299—Borup very fine sandy loam
1304A—Glyndon very fine sandy loam, 0 to 2 percent slopes
1304B—Glyndon very fine sandy loam, 2 to 6 percent slopes
1315A—Wheatville very fine sandy loam, 0 to 2 percent slopes
1804—Hamre muck, ponded
1807—Cathro muck, ponded
1808—Markey muck, ponded
1871—Fargo silty clay, swales
1874—Radium loamy sand
1878—Hamre muck
1882—Rosewood, Strathcona, and Berner soils, seepy
1963—Bearden-Colvin complex
1964—Colvin-Fargo complex
1966—Rosewood-Hamar complex

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Soil Survey of
Marshall County, Minnesota

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Interpretive ratings help engineers, planners, and others understand how soil properties influence important nonagricultural uses, such as building site development and construction materials. The ratings indicate the most restrictive soil features affecting the suitability of the soils for these uses.

Soils are rated in their natural state. No unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Even though soils may have limitations, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most of the limitations. Most of these practices, however, are costly. The final decision in selecting a site for a particular use generally involves weighing the costs of site preparation and maintenance.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The classification and extent of the soils in this survey area are shown in the tables “Classification of the Soils” and “Acreage and Proportionate Extent of the Soils,” which are at the end of this section.

Classification of the Soils

Soil name	Family or higher taxonomic class
Augsburg	Typic Calciaquolls, coarse-silty over clayey, mixed, smectitic, superactive, frigid
Bearden	Aeric Calciaquolls, fine-silty, mixed, superactive, frigid
Berner	Terric Borosaprists, loamy, mixed, euic
Boash	Vertic Epiaquolls, clayey over loamy, smectitic, mixed, superactive, calcareous, frigid
Borup	Typic Calciaquolls, coarse-silty, mixed, superactive, frigid
Cathro	Terric Borosaprists, loamy, mixed, euic
Clearriver	Aquic Udipsamments, mixed, frigid
Clearwater	Typic Epiaquerts, fine, smectitic, frigid
Colvin	Typic Calciaquolls, fine-silty, mixed, superactive, frigid
Corliss	Typic Udipsamments, mixed, frigid
Cormant	Mollic Psammaquents, mixed, frigid
Deerwood	Histic Humaquepts, sandy, mixed, frigid
Dora	Terric Borosaprists, clayey, smectitic, euic
Eaglepoint	Aeric Calciaquerts, very fine, smectitic, frigid
Eckvoll	Aquic Arenic Eutroboralfs, loamy, mixed, superactive
Enstrom	Aquic Udorthents, sandy over loamy, mixed, superactive, nonacid, frigid
Espelie	Typic Epiaquolls, sandy over clayey, mixed, smectitic, frigid
Fargo	Typic Epiaquerts, fine, smectitic, frigid
Flaming	Aquic Haploborolls, sandy, mixed
Fluvaquents	Fluvaquents, loamy
Foldahl	Aquic Haploborolls, sandy over loamy, mixed, superactive
Foxhome	Aquic Haploborolls, sandy-skeletal over loamy, mixed, superactive
Garnes	Aquic Eutroboralfs, fine-loamy, mixed, superactive
Glyndon	Aeric Calciaquolls, coarse-silty, mixed, superactive, frigid
Grimstad	Aeric Calciaquolls, sandy over loamy, mixed, superactive, frigid
Grygla	Mollic Endoaquents, sandy over loamy, mixed, superactive, nonacid, frigid
Hamar	Typic Endoaquolls, sandy, mixed, frigid
Hamerly	Aeric Calciaquolls, fine-loamy, mixed, superactive, frigid
Hamre	Histic Humaquepts, fine-loamy, mixed, superactive, nonacid, frigid
Hangaard	Typic Endoaquolls, sandy, mixed, frigid
Haploborolls	Haploborolls, loamy
Haug	Histic Humaquepts, coarse-loamy, mixed, superactive, calcareous, frigid
Hegne	Typic Calciaquerts, fine, smectitic, frigid
Hilaire	Aquic Haploborolls, sandy over clayey, mixed, smectitic
Huot	Aquic Calciborolls, sandy over clayey, mixed, smectitic
Karlstad	Aquic Eutroboralfs, coarse-loamy, mixed, superactive
Kittson	Aquic Haploborolls, fine-loamy, mixed, superactive
Kratka	Typic Epiaquolls, sandy over loamy, mixed, superactive, frigid
Lamoure	Cumulic Endoaquolls, fine-silty, mixed, superactive, calcareous, frigid
Linveldt	Aquic Argiborolls, coarse-loamy, mixed, superactive
Lupton	Typic Borosaprists, euic
Markey	Terric Borosaprists, sandy or sandy-skeletal, mixed, euic
Marquette	Ochreptic Eutroboralfs, loamy-skeletal, mixed, superactive
Mavie	Typic Calciaquolls, sandy-skeletal over loamy, mixed, superactive, frigid
Nereson	Aquic Argiborolls, coarse-loamy, mixed, superactive
Newfolden	Abruptic Udic Argiborolls, clayey over loamy, smectitic, mixed, superactive
Northcote	Typic Epiaquerts, very fine, smectitic, frigid
Northwood	Histic Humaquepts, sandy over loamy, mixed, superactive, nonacid, frigid
Pelan	Aquic Argiborolls, loamy-skeletal, mixed, superactive
Percy	Typic Calciaquolls, coarse-loamy, mixed, superactive, frigid
Poppleton	Aquic Udipsamments, mixed, frigid
Radium	Aquic Haploborolls, sandy, mixed
Redby	Aquic Udipsamments, mixed, frigid
Reiner	Abruptic Udic Argiborolls, fine-loamy, mixed, superactive
Reis	Typic Calciaquerts, fine, smectitic, frigid
Rifle	Typic Borohemists, euic
Roliss	Typic Endoaquolls, fine-loamy, mixed, superactive, calcareous, frigid
Rosewood	Typic Calciaquolls, sandy, mixed, frigid
Rushlake	Aquic Udipsamments, mixed, frigid
Sahkahtay	Mollic Endoaqualfs, fine-loamy over sandy or sandy-skeletal, mixed, superactive, frigid
Sandberg	Udorthentic Haploborolls, sandy, mixed
Seelyeville	Typic Borosaprists, euic

Classification of the Soils--Continued

Soil name	Family or higher taxonomic class
Skagen	Aquic Calciborolls, coarse-loamy, mixed, superactive
Smiley	Typic Argiaquolls, fine-loamy, mixed, superactive, frigid
Strandquist	Typic Endoquolls, sandy-skeletal over loamy, mixed, superactive, calcareous, frigid
Strathcona	Typic Calciaquolls, sandy over loamy, mixed, superactive, frigid
Syrene	Typic Calciaquolls, sandy, mixed, frigid
Tacoosh	Terric Borohemists, loamy, mixed, euic
Thiefriver	Typic Calciaquolls, sandy over clayey, mixed, smectitic, frigid
Udipsamments	Udipsamments
Ulen	Aeric Calciaquolls, sandy, mixed, frigid
Vallers	Typic Calciaquolls, fine-loamy, mixed, superactive, frigid
Wahpeton	Typic Hapluderts, fine, smectitic, frigid
Wheatville	Aeric Calciaquolls, coarse-silty over clayey, mixed, smectitic, superactive, frigid
Wildwood	Histic Humaquepts, very fine, smectitic, nonacid, frigid
Wyandotte	Typic Calciaquolls, sandy-skeletal over clayey, smectitic, frigid

Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
47	Colvin silty clay loam	14,951	1.3
57A	Fargo silty clay, 0 to 2 percent slopes	70,440	6.1
58	Kittson loam	5,576	0.5
59	Grimstad fine sandy loam	46,086	4.0
65	Foxhome sandy loam	6,380	0.5
66	Flaming loamy fine sand	20,883	1.8
67A	Bearden silt loam, 0 to 2 percent slopes	5,355	0.5
67B	Bearden silt loam, 2 to 6 percent slopes	2,201	0.2
77	Garnes fine sandy loam	1,342	0.1
93A	Bearden silty clay loam, 0 to 2 percent slopes	1,609	0.1
111	Hangaard sandy loam	1,423	0.1
116	Redby loamy fine sand	4,196	0.4
117	Cormant loamy fine sand	1,472	0.1
145	Enstrom loamy fine sand	2,331	0.2
148	Poppleton fine sand	7,168	0.6
157A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded	10,307	0.9
157B	Wahpeton silty clay, 2 to 6 percent slopes, occasionally flooded	925	*
184A	Hamerly loam, 0 to 3 percent slopes	2,281	0.2
187	Haug muck	6,665	0.6
205	Karlstad loamy sand	6,969	0.6
236	Vallers loam	28,436	2.4
242B	Marquette loamy sand, 1 to 8 percent slopes	2,331	0.2
258B	Sandberg loamy sand, 1 to 6 percent slopes	10,589	0.9
280	Pelan sandy loam	9,452	0.8
372	Hamar loamy fine sand	540	*
379	Percy loam, very cobbly	1,164	0.1
383	Percy loam	11,958	1.0
384	Percy mucky loam, depressional	785	*
387	Roliss loam, depressional	2,504	0.2
412	Mavie fine sandy loam	31,967	2.8
418	Lamoure silty clay loam, occasionally flooded	1,749	0.2
426	Foldahl loamy fine sand	13,202	1.1
429A	Northcote clay, 0 to 2 percent slopes	23,470	2.0
432	Strandquist loam	10,236	0.9
435	Syrene sandy loam	9,572	0.8
439	Strathcona fine sandy loam	45,792	3.9
481	Kratka fine sandy loam	37,461	3.2
482	Grygla loamy fine sand	2,652	0.2
514	Tacoosh muck	2,410	0.2
540	Seelyeville muck	6,331	0.5
541	Rifle mucky peat	7,818	0.7
543	Markey muck	10,118	0.9
544	Cathro muck	11,884	1.0
546	Lupton muck	2,503	0.2
547	Deerwood muck	7,387	0.6
550	Dora muck	10,543	0.9
563	Northwood muck	28,967	2.5
565	Eckvoll loamy fine sand	9,208	0.8
582	Roliss loam	28,970	2.5
583	Nereson fine sandy loam	2,626	0.2
630	Wildwood muck	4,800	0.4
641	Clearwater clay	8,726	0.8
642	Clearwater loam	20,639	1.8
643	Huot fine sandy loam	10,479	0.9
644	Boash clay loam	3,583	0.3
645	Espelie fine sandy loam	4,653	0.4
647	Hilaire loamy fine sand	3,311	0.3
648	Newfolden loam	1,161	0.1
649	Reiner loamy fine sand	3,133	0.3
650	Reiner fine sandy loam	16,916	1.4
651	Thiefriver fine sandy loam	3,271	0.3
652	Wyandotte clay loam	5,651	0.5

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
653	Smiley mucky loam, depressional	4,023	0.3
708	Rushlake loamy sand	1,929	0.2
712	Rosewood fine sandy loam	16,264	1.4
713	Linveldt fine sandy loam	2,528	0.2
721B	Corliss loamy sand, 1 to 6 percent slopes	2,188	0.2
765	Smiley loam	68,137	5.9
794	Clearriver loamy fine sand	4,076	0.4
935	Hegne-Fargo complex	51,548	4.4
936	Clearwater-Reis complex	2,646	0.2
937	Eaglepoint-Northcote complex	15,927	1.4
972	Roliss-Vallers complex	33,450	2.9
1006	Fluvaquents-Haploborolls complex, 0 to 30 percent slopes, flooded	10,864	0.9
1030	Pits, gravel-Udipsamments complex	2,996	0.2
1031	Seelyeville muck, ponded	1,071	*
1143	Berner-Markey complex	1,525	0.1
1144	Strathcona and Kratka soils, depressional	4,595	0.4
1146	Northwood muck, ponded	785	*
1158	Skagen loam	711	*
1170	Skagen loam, very cobbly	797	*
1187	Dora muck, ponded	8,685	0.7
1188	Wildwood muck, ponded	7,271	0.6
1189	Clearwater mucky loam, depressional	2,664	0.2
1191	Sahkahtay sandy loam	897	*
1264	Ulen loamy fine sand	44,686	3.8
1297	Augsburg very fine sandy loam	1,784	0.2
1299	Borup very fine sandy loam	3,418	0.3
1304A	Glyndon very fine sandy loam, 0 to 2 percent slopes	15,828	1.4
1304B	Glyndon very fine sandy loam, 2 to 6 percent slopes	559	*
1315A	Wheatville very fine sandy loam, 0 to 2 percent slopes	23,707	2.0
1804	Hamre muck, ponded	8,950	0.8
1807	Cathro muck, ponded	7,985	0.7
1808	Markey muck, ponded	1,140	*
1871	Fargo silty clay, swales	635	*
1874	Radium loamy sand	4,904	0.4
1878	Hamre muck	13,776	1.2
1882	Rosewood, Strathcona, and Berner soils, seepy	476	*
1963	Bearden-Colvin complex	24,486	2.1
1964	Colvin-Fargo complex	50,560	4.4
1966	Rosewood-Hamar complex	321	*
	Water	33,800	2.9
	Total	1,160,100	100.0

* Less than 0.1 percent.

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Agronomy

General management needed for crops and for hay and pasture is suggested in this section. The system of land capability classification used by the Natural Resources Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider obtaining specific information from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

More than 940,000 acres in Marshall County is used for crops and pasture. In 1990, about 495,000 acres was used for small grain crops, mainly wheat, barley, and oats. Row crops, including sunflowers, corn, and soybeans, were grown on about 23,000 acres. Other important crops include sugar beets, which were grown on 25,000 acres; potatoes, on 11,000 acres; and dry edible beans, on 11,000 acres. The remaining acreage was used for minor crops or for hay and pasture or was summer-fallowed or idle cropland (Minnesota Agricultural Statistics Service, 1991).

The soils in Marshall County are generally well suited to crop production. Productivity could be increased by extending the latest crop production technology to all of the cropland in the county. This soil survey can greatly facilitate the application of such technology.

Measures that control erosion, remove excess surface water, conserve moisture, and improve fertility and tilth are the main management needs in cultivated areas of Marshall County.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil or underlying material is incorporated into the plow layer. Erosion by wind is a hazard on nearly all of the soils in the county. It is especially damaging in areas of soils that have a sandy surface layer and a low or moderate available water capacity. Some of the soils most susceptible to erosion by wind are Sandberg, Ulen, Flaming, Foldahl, and Eckvoll soils. Second, soil movement by wind or water action may result in the sedimentation of streams and drainage ditches. Erosion-control measures improve the quality of water. They are also important for the proper management of water resources because they minimize the damage caused by temporary flooding. Practices that control erosion may also increase the supply of available moisture during the growing season by reducing the runoff rate, holding snow cover, and increasing the rate of water infiltration.

A cropping system that maintains a cover of vegetation or surface mulch or a tillage system that keeps the surface rough helps to hold soil loss to a rate that does not reduce the productive capacity of the soils. Windbreaks of adapted trees or shrubs, such as green ash, eastern cottonwood, or Siberian peashrub, are effective in reducing the hazard of wind erosion on many of the soils used as cropland (fig. 1). On farms that produce livestock, including legumes and grasses in the cropping system improves fertility and soil tilth and reduces the hazard of erosion, especially in areas of sloping and sandy soils.

Water erosion is a hazard mainly where overland water flow becomes concentrated. It can occur on any of the soils where cover is inadequate.

Information regarding the design of erosion-control practices for each kind of soil is provided in the Technical Guide, which is available in local offices of the Natural Resources Conservation Service and the Soil and Water Conservation District.

Excess surface water is the major limitation on about 40 percent of the acreage used for crops in the county. Some soils are naturally so wet that the production of the common crops is not possible unless artificial drainage is provided. Draining many of the areas of organic soils is generally not economically feasible.

Open field ditches are commonly used to reduce wetness. Many miles of drainage ditches have been installed in Marshall County. Approximately 75 percent of the wet soils have been drained.

The land has been leveled in many areas of Colvin, Bearden, Hegne, Fargo, and Northcote soils on the valley floor in western Marshall County.

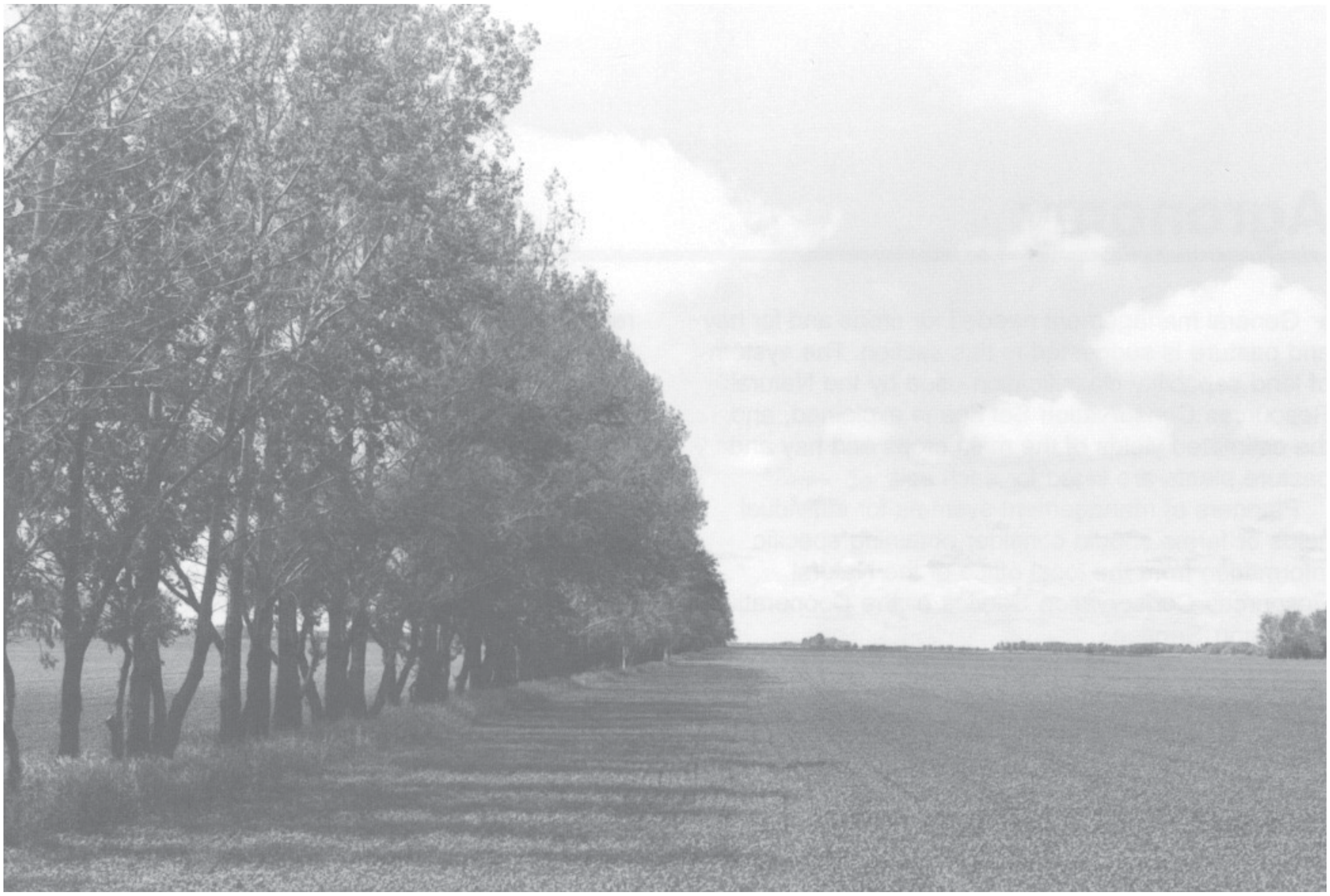

Figure 1.—This field windbreak helps to control erosion in an area of Fargo silty clay, 0 to 2 percent slopes.

Maintenance of the fields by annual grading and cleaning of ditches is a common management practice on these nearly level soils.

Information concerning the design of drainage systems for each kind of soil is provided in the Technical Guide, which is available at the local office of the Natural Resources Conservation Service and the Soil and Water Conservation District.

Natural soil fertility is medium or high in most of the soils in the county. It is low, however, in Karlstad, Marquette, Pelan, Poppleton, Redby, Sandberg, Deerwood, Markey, and Ulen soils. Many of the soils are slightly or moderately alkaline. Other soils, such as Foxhome, Kittson, Reiner, and Smiley soils, typically have a neutral surface layer. A few soils, including Clearwater and Poppleton soils, have a slightly acid surface layer.

Crops on most of the soils in the county respond well to fertilizer. The kinds and amounts of fertilizer needed depend on the kind of soil, on past and present management, and on the crops selected. This soil survey provides detailed information on soil types. Different soils may have the same or similar physical properties, but management techniques can alter the natural fertility of the soils in various ways. Soil tests are needed to provide indications of soil reaction (pH) and soil fertility. Soil pH has an effect on a plant's ability to utilize various nutrients. Proper interpretations of soil test results by the county extension agent or other qualified persons are necessary so that the proper composition and application rates for fertilizer can be chosen.

Maintaining good soil structure and tilth is important in preparing a desirable seedbed. Soils that have good structure or tilth are granular and porous. Regular applications of crop residue, manure, and other organic material can improve soil structure. Cultivating moderately fine and fine textured soils when they are wet damages soil structure and makes seedbed preparation difficult.

Some soils used for crops in the survey area have weak structure. These soils, such as those of the

Garnes series, have a surface layer of fine sandy loam that is moderately low in organic matter content. Intense rainfall causes the formation of a crust on the surface. As the soil dries, the crust becomes hard. The formation of a crust reduces the infiltration rate and increases the runoff rate. Minimum tillage and regular additions of crop residue, manure, and other organic material improve structure and help to prevent crusting.

Including grasses and legumes in the cropping sequence and growing green manure crops help to keep the soil in good tilth. These practices are common in the county. Plowing in the fall when the soils are at the proper moisture content helps to maintain good tilth in areas of clayey soils, such as Clearwater, Fargo, Hegne, and Wahpeton soils, and facilitates the preparation of a good seedbed.

Stone removal is generally needed on soils that formed in till. Reiner, Hamerly, and Smiley soils are examples.

Further information about crops and management practices is available from local offices of the Cooperative Extension Service and the Natural Resources Conservation Service and from the Marshall County Soil and Water Conservation District.

Soil Salinity

D.D. Patterson, soils department, North Dakota State University, helped prepare this section.

Scattered saline areas occur in the western part of the county in the Red River Valley. They are in areas of the Colvin-Bearden, Fargo-Colvin-Hegne, and Northcote-Eaglepoint associations, which are described under the heading “General Soil Map Units” in Part I of this survey.

Most of the saline areas are small and could not be mapped separately. Using infrared photography during a time of crop stress can enable the delineation of saline areas, but this technique was not possible during the time the survey was made.

Plants growing on saline soils absorb salts from soil solution. Excess amounts of certain salts may interfere with plant metabolism or vital growth processes. High concentrations of some salts are toxic to certain plants. Other salts may cause nutritional imbalances or deficiencies by restricting the uptake or availability of essential plant nutrients.

Detecting salinity by visual observation in the field is difficult. The salts are not visible during much of the growing season because of moisture in the soil. The flecks, threads, or masses of soluble salts are visible only when the soil is dry.

Saline soils have a layer of accumulated lime within 16 inches of the surface. If the soils have been plowed, part of the lime zone has been mixed with the black surface soil. The soils are grayer when dry. The color of the surface layer, however, does not necessarily indicate a high concentration of salts. Laboratory analysis is needed to determine the actual salinity of areas within the same field that are similar in surface color.

Crop response, particularly during periods of soil moisture stress, is a useful indicator of the degree of salinity. For instance, small grain on saline soils tends to be stunted and to have shorter stems, smaller leaves, fewer tillers, and shorter seed heads than small grain on nonsaline soils. If crops are grown in fields where the degree of salinity varies, the plants vary in height. In some areas severe salinity prevents crop growth.

A measure of the effect of soil salinity on vegetative growth is not necessarily a reliable measure of crop yields. Yields of barley and wheat seeds, for example, generally are reduced to a lesser extent than the vegetative growth. Yields of storage roots in sugar beets and potatoes commonly are reduced more than the vegetative growth of fibrous roots or tops.

The field crops and forage plants commonly grown in the county are grouped according to relative salt tolerance. The degree of tolerance declines from the first to the last crop in each group, but a difference in ranking of two or three places probably is not significant. Of the field crops, none exhibit high tolerance; sugar beets (after emergence), barley, safflower, rape, rye, oats, and wheat exhibit moderate tolerance; and soybeans, corn, sunflowers, flax, potatoes, field peas, and field beans exhibit low tolerance. Of the forage crops, tall wheatgrass, tall fescue, slender wheatgrass, Russian wildrye, and western wheatgrass exhibit high tolerance; sweetclover, sudangrass, millet, alfalfa (once established), crested wheatgrass, smooth bromegrass, intermediate wheatgrass, Canada wildrye, and reed canarygrass exhibit moderate tolerance; and alfalfa seedlings exhibit low tolerance.

Trees and shrubs also exhibit varying degrees of tolerance to soil salinity. The growth and survival of seedlings and transplants of evergreen and deciduous trees are restricted in areas of slightly saline soils.

Cropland Management Considerations

The management concerns affecting the use of the detailed soil map units in the survey area for crops are shown in the table "Cropland Management Considerations." The main concerns in managing nonirrigated cropland are conserving moisture, controlling wind erosion and water erosion, and maintaining soil fertility.

Conserving moisture consists primarily of reducing the evaporation and runoff rates and increasing the water infiltration rate. Applying conservation tillage and conservation cropping systems, farming on the contour, stripcropping, establishing field windbreaks, and leaving crop residue on the surface conserve moisture.

Generally, a combination of several practices is needed to control *wind erosion* and *water erosion.* Conservation tillage, stripcropping, field windbreaks, contour farming, conservation cropping systems, crop residue management, terraces, diversions, and grassed waterways help to prevent excessive soil loss.

Measures that are effective in maintaining *soil fertility* include applying fertilizer, both organic and inorganic, including manure; incorporating crop residue or green manure crops into the soil; and using proper crop rotations. Controlling erosion helps to prevent the loss of organic matter and plant nutrients and thus helps to maintain productivity, although the level of fertility can be reduced even in areas where erosion is controlled. All soils used for nonirrigated crops respond well to applications of fertilizer.

Some of the considerations shown in the table cannot be easily overcome. These are *channels, flooding, gullies,* and *ponding.*

Additional considerations are as follows:

Lime content, limited available water capacity, potential poor tilth and compaction, and restricted permeability.—These limitations can be minimized by incorporating green manure crops, manure, or crop residue into the soil; applying a system of conservation tillage; and using conservation cropping systems. Also, crops may respond well to additions of phosphate fertilizer to soils that have a high content of lime.

Potential for ground-water contamination.—The proper use of nutrients and pesticides can reduce the risk of ground-water contamination.

Potential for surface-water contamination.—The risk of surface-water contamination can be reduced by the proper use of nutrients and pesticides and by conservation farming practices that reduce the runoff rate.

Surface rock fragments.—This limitation causes rapid wear of tillage equipment. It cannot be easily overcome.

Surface stones.—Stones or boulders on or near the surface can hinder normal tillage unless they are removed.

Salt content.—In areas where this is a limitation, only salt-tolerant crops should be grown.

On irrigated soils the main management concerns are *efficient water use, nutrient management, control of erosion, pest and weed control,* and *timely planting and harvesting* for a successful crop. An irrigation system that provides optimum control and distribution of water at minimum cost is needed. Overirrigation wastes water, leaches plant nutrients, and causes erosion. Also, it can create drainage problems, raise the water table, and increase soil salinity.

Explanation of Criteria

Acid soil.—The pH is less than 6.1.

Channeled.—The word "channeled" is included in the map unit name.

Dense layer.—The bulk density is 1.80 g/cc or greater within the soil profile.

Depth to rock.—The depth to bedrock is less than 40 inches.

Excessive permeability.—Permeability is 6 inches per hour or more within the soil profile.

Flooding.—Flooding is occasional or frequent.

Gullied.—The word "gullied" is included in the map unit name.

High organic matter content.—The surface layer has more than 20 percent organic matter.

Lime content.—The pH is 7.4 or more in the surface layer, or the wind erodibility group is 4L.

Limited available water capacity.—The available water capacity calculated to a depth of 60 inches or to a root-limiting layer is 6 inches or less.

Limited organic matter content.—The content of organic matter is 2 percent or less in the surface layer.

Ponding.—Ponding duration is assigned to the map unit component. The water table is above the surface.

Potential poor tilth and compaction.—The content of clay is 27 percent or more in the surface layer.

Potential for ground-water contamination (by nutrients or pesticides).—Depth to the water table is 4 feet or less, the permeability of any layer is more than 6.0 inches per hour, or the depth to bedrock is less than 60 inches.

Potential for surface-water contamination (by nutrients or pesticides).—The map unit component is occasionally flooded or frequently flooded, is subject to ponding, is assigned to hydrologic group C or D and has a slope of more than 2 percent, is assigned to hydrologic group A and has a slope of more than 6 percent, or is assigned to hydrologic group B, has a slope of 3 percent or more, and has a K factor of more than 0.17.

Previously eroded.—The word "eroded" is included in the map unit name.

Restricted permeability.—Permeability is less than 0.06 inch per hour within the soil profile.

Salt content.—The electrical conductivity is 4 or more in the surface layer or 8 or more within a depth of 30 inches.

Slope (equipment limitation).—The slope is more than 15 percent.

Surface rock fragments (equipment limitation).—The terms describing the texture of the surface layer include any rock fragment modifier, except for gravelly, channery, stony, very stony, extremely stony, bouldery, very bouldery, and extremely bouldery.

Surface stones (equipment limitation).—The word "stony" or "bouldery" is included in the map unit name or in the description of the surface layer.

Water erosion.—Either the slope is 6 percent or more, or the slope is more than 3 percent and less than 6 percent and the surface layer is not sandy.

Water table.—A water table is within 2.5 feet of the surface.

Wind erosion.—The wind erodibility group is 1, 2, 3, or 4L.

Crop Yield Estimates

The average yields per acre that can be expected of the principal crops under a high level of management are shown in the table "Land Capability and Yields per Acre of Crops and Pasture." In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in the table are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Pasture and Hayland Interpretations

Under good management, proper grazing is essential for the production of high-quality forage, stand survival, and erosion control. Proper grazing helps plants to maintain sufficient and generally vigorous top growth during the growing season. Brush control is essential in many areas, and weed control generally is needed. Rotation grazing and renovation also are important management practices.

Yield estimates are often provided in animal unit months (AUM), or the amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about forage yields other than those shown in the table "Land Capability and Yields per Acre of Crops and Pasture."

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils generally are grouped at three levels—capability class, subclass, and unit (USDA, 1961). These categories indicate the degree and kinds of limitations affecting mechanized farming systems that produce the more commonly grown field crops, such as corn, small grain, cotton, hay, and field-grown vegetables. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by numerals 1 through 8. The numerals indicate progressively greater limitations and narrower choices for practical use.

If properly managed, soils in classes 1, 2, 3, and 4 are suitable for the mechanized production of commonly grown field crops and for pasture and woodland. The degree of the soil limitations affecting the production of cultivated crops increases progressively from class 1 to class 4. The limitations can affect levels of production and the risk of permanent soil deterioration caused by erosion and other factors.

Soils in classes 5, 6, and 7 are generally not suited to the mechanized production of commonly grown field crops without special management, but they are suitable for plants that provide a permanent cover, such as grasses and trees. The severity of the soil limitations affecting crops increases progressively from class 5 to class 7.

Areas in class 8 are generally not suitable for crops, pasture, or woodland without a level of management that is impractical. These areas may have potential for other uses, such as recreational facilities and wildlife habitat.

Capability subclasses identify the dominant kind of limitation in the class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless a close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

There are no subclasses in class 1 because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use mainly to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the table “Land Capability and Yields per Acre of Crops and Pasture” at the end of this section.

Prime Farmland

Prime farmland is of major importance in meeting the Nation’s short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, State, and Federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation’s prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops in an economic manner. The soils need only to be treated and managed by acceptable farming methods. An adequate moisture supply and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, or woodland or for other purposes. They either are used for food and fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in National forests, National parks, military reservations, and State parks.

Prime farmland soils commonly receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable, and the level of acidity or alkalinity and the content of salts and sodium are acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods, and they are not frequently flooded during the growing season or are protected from flooding. Slopes range mainly from 0 to 6 percent.

Soils that have a high water table or are subject to flooding may qualify as prime farmland where these limitations are overcome by drainage measures or flood control. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information about the criteria for prime farmland can be obtained at the local office of the Natural Resources Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 709,000 acres, or nearly 61 percent of the survey area, meets the requirements for prime farmland.

The map units in the survey area that meet the requirements for prime farmland are listed in the table "Prime Farmland." This list does not constitute a recommendation for a particular land use. On some soils included in the table, measures that overcome limitations are needed. The need for these measures is indicated in parentheses after the map unit name. The location of each map unit is shown on the detailed soil maps. The soil qualities that affect use and management are described in the section "Soil Series and Detailed Soil Map Units" in Part I of this survey.

Erosion Factors

Soil erodibility (K) and soil-loss tolerance (T) factors are used in an equation that predicts the amount of soil lost through water erosion in areas of cropland. The procedure for predicting soil loss is useful in guiding the selection of soil and water conservation practices. The erosion factors for the soils in the survey area are listed in the table "Physical Properties of the Soils."

Soil Erodibility (K) Factor

The soil erodibility (K) factor indicates the susceptibility of a soil to sheet and rill erosion by water. The soil properties that influence erodibility are those that affect the infiltration rate, the movement of water through the soil, and the water storage capacity of the soil and those that allow the soil to resist dispersion, splashing, abrasion, and the transporting forces of rainfall and runoff. The most important soil properties are the content of silt plus very fine sand, the content of sand coarser than very fine sand, the content of organic matter, soil structure, and permeability.

Fragment-Free Soil Erodibility (Kf) Factor

This is one of the factors used in the revised Universal Soil Loss Equation. It shows the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Soil-Loss Tolerance (T) Factor

The soil-loss tolerance (T) factor is an estimate of the maximum annual rate of soil erosion that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons of soil loss per acre per year. Ratings of 1 to 5 are used, depending on soil properties and prior erosion. The criteria used in assigning a T factor to a soil include maintenance of an adequate rooting depth for crop production, potential reduction of crop yields, maintenance of water-control structures affected by sedimentation, prevention of gullying, and the value of nutrients lost through erosion.

Wind Erodibility Groups

Wind erodibility is directly related to the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. From this percentage, the wind erodibility index (I) factor is determined. This factor is an expression of the stability of the soil aggregates, or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles. Soils are assigned to wind erodibility groups (WEG) having similar percentages of dry soil aggregates larger than 0.84 millimeter. The wind erodibility groups are listed in the table "Physical Properties of the Soils."

Additional information about wind erodibility groups and K, Kf, T, and I factors can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service.

Windbreaks and Environmental Plantings

Leonard Zilka and Tim Finseth, Marshall County Soil and Water Conservation District, helped prepare this section.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Windbreaks are often planted on land that did not originally support trees. Knowledge of how trees perform on such land can be gained only by observing and recording the performance of trees that have been planted and have survived. Many popular windbreak species are not indigenous to the areas in which they are planted.

Each tree or shrub species has certain climatic and physiographic limits. Within these parameters, a tree or shrub may grow well or grow poorly, depending on the characteristics of the soil. Each tree or shrub has definable potential heights in a given physiographic area and under a given climate. Accurate definitions of potential heights are necessary when a windbreak is planned and designed.

The table “Windbreaks and Environmental Plantings” shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in this table are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a nursery.

Windbreaks are of significant importance in protecting the soils from erosion in Marshall County. The primary limitations in establishing windbreaks in Marshall County are a high pH, a high content of lime, wetness, droughtiness (on some sandy soils), and small areas of saline soils. Other important considerations are weed control and chemical drift from adjacent fields (Minnesota Soil and Water Conservation District, 1986).

Soils that have a high pH as a result of carbonates are common. These soils are in windbreak suitability groups 1K and 2K, which are described below. Trees that grow well in these areas are green ash and white spruce.

Wetness is a problem on the some of the soils in western Marshall County and on the organic soils in the eastern part of the county. These soils are in windbreak suitability groups 2K and 2W.

Droughtiness is a problem on some of the soils in the central part of the county. These soils are in windbreak suitability group 7.

On a small number of soils in western Marshall County, salinity and soluble salts inhibit tree growth. These soils are in windbreak suitability groups 1K and 2K.

Windbreak Suitability Groups

Windbreak suitability groups consist of soils in which the kinds and degrees of the hazards and limitations that affect the survival and growth of trees and shrubs in windbreaks are about the same.

Group 1 consists of soils that are somewhat poorly drained or moderately well drained, are rapidly permeable to moderately slowly permeable, and do not have free carbonates in the upper 20 inches.

Group 1K consists of soils that are somewhat poorly drained or moderately well drained, are rapidly permeable to moderately slowly permeable, and have free carbonates within 20 inches of the surface. These soils may be very slightly saline or slightly saline (the electrical conductivity is 2 to 8).

Group 2 consists of poorly drained soils that have been artificially drained and do not have free carbonates in the upper 20 inches. Permeability varies.

Group 2K consists of poorly drained or very poorly drained soils that have been artificially drained and have free carbonates within 20 inches of the surface. Permeability varies. These soils may be very slightly saline or slightly saline (the electrical conductivity is 2 to 8).

Group 2H consists of very poorly drained soils that have been artificially drained and have more than 16 inches of organic material. Permeability varies.

Group 2W consists of very poorly drained soils that are subject to ponding and have been artificially drained. It includes soils that have an organic surface layer up to 16 inches thick. Permeability varies.

Group 3 consists of soils that are well drained or moderately well drained and are loamy or silty throughout. Permeability is moderate or moderately slow. These soils do not have free carbonates in the upper 20 inches.

Group 4 consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a silty or loamy surface layer and a clayey subsoil. Permeability is slow or very slow.

Group 4C consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a clayey surface layer and subsoil. Permeability is slow or very slow.

Group 4F consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a substratum of dense till. Permeability is slow or very slow.

Group 5 consists of soils that are excessively drained to moderately well drained and have a moderate available water capacity. These soils are dominantly fine sandy loam or sandy loam, but some are sandy in the upper part and loamy in the lower part.

Group 6G consists of excessively drained to moderately well drained soils that are loamy in the upper part and have sand or sand and gravel at a depth of 20 to 40 inches. These soils have a low or moderate available water capacity.

Group 6D consists of excessively drained to moderately well drained, loamy soils that have bedrock at a depth of 20 to 40 inches. These soils have a low or moderate available water capacity.

Group 7 consists of excessively drained to well drained soils that are dominantly loamy fine sand or coarser textured and are shallow to sand or to sand and gravel. These soils have a low available water capacity.

Group 8 consists of excessively drained to well drained, loamy soils that have free carbonates within 20 inches of the surface.

Group 9W consists of soils that are somewhat poorly drained, poorly drained, or very poorly drained and are moderately saline (the electrical conductivity is 8 to 16).

Group 10 consists of soils or miscellaneous land types that generally are not suitable for windbreaks. One or more characteristics, such as soil depth, texture, wetness, available water capacity, or slope, limit the planting, survival, or growth of trees and shrubs.

Cropland Management Considerations

(See text for a description of the considerations listed in this table)

Map symbol and soil name	Cropland management considerations
47:	
Colvin	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
57A:	
Fargo	Potential for ground-water contamination Potential poor tilth and compaction Water table
58:	
Kittson	Potential for ground-water contamination Potential for surface-water contamination
59:	
Grimstad	Excessive permeability Lime content Potential for ground-water contamination Wind erosion
65:	
Foxhome	Excessive permeability Potential for ground-water contamination Wind erosion
66:	
Flaming	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
67A:	
Bearden	Lime content Potential for ground-water contamination Water table Wind erosion
67B:	
Bearden	Lime content Potential for ground-water contamination Potential for surface-water contamination Water erosion Water table Wind erosion
77:	
Garnes	Limited organic matter content Potential for ground-water contamination Wind erosion
93A:	
Bearden	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
111:	
Hangaard	Excessive permeability Limited available water capacity Potential for ground-water contamination Water table Wind erosion
116:	
Redby	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Water table Wind erosion
117:	
Cormant	Excessive permeability Limited available water capacity Potential for ground-water contamination Water table Wind erosion
145:	
Enstrom	Excessive permeability Potential for ground-water contamination Wind erosion
148:	
Poppleton	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
157A:	
Wahpeton	Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction
157B:	
Wahpeton	Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion
184A:	
Hamerly	Lime content Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
187:	
Haug	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
205:	
Karlstad	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
236:	
Vallers	Lime content Potential for ground-water contamination Water table Wind erosion
242B:	
Marquette	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Wind erosion
258B:	
Sandberg	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
280:	
Pelan	Excessive permeability Potential for ground-water contamination Wind erosion
372:	
Hamar	Limited available water capacity Potential for ground-water contamination Water table Wind erosion
379:	
Percy	Potential for ground-water contamination Water table
383:	
Percy	Potential for ground-water contamination Water table
384:	
Percy	Lime content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
387:	
Roliss	Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
412:	
Mavie	Excessive permeability Lime content Potential for ground-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
418:	
Lamoure	Flooding Lime content Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table Wind erosion
426:	
Foldahl	Excessive permeability Potential for ground-water contamination Wind erosion
429A:	
Northcote	Potential for ground-water contamination Potential poor tilth and compaction Water table
432:	
Strandquist	Excessive permeability Lime content Potential for ground-water contamination Water table Wind erosion
435:	
Syrene	Excessive permeability Lime content Limited available water capacity Potential for ground-water contamination Water table Wind erosion
439:	
Strathcona	Excessive permeability Lime content Potential for ground-water contamination Water table Wind erosion
481:	
Kratka	Excessive permeability Potential for ground-water contamination Water table Wind erosion
482:	
Grygla	Excessive permeability Potential for ground-water contamination Water table Wind erosion
514:	
Tacoosh	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
540:	
Seelyeville	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
541:	
Rifle	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
543:	
Markey	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
544:	
Cathro	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
546:	
Lupton	High organic matter content Potential for ground-water contamination Water table Wind erosion
547:	
Deerwood	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
550:	
Dora	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Water table Wind erosion
563:	
Northwood	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
565:	
Eckvoll	Excessive permeability Potential for ground-water contamination Water table Wind erosion
582:	
Roliss	Lime content Potential for ground-water contamination Water table Wind erosion
583:	
Nereson	Potential for ground-water contamination Wind erosion
630:	
Wildwood	High organic matter content Limited available water capacity Ponding Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Water table Wind erosion
641:	
Clearwater	Potential for ground-water contamination Potential poor tilth and compaction Water table
642:	
Clearwater	Potential for ground-water contamination Water table
643:	
Huot	Excessive permeability Lime content Potential for ground-water contamination Wind erosion
644:	
Boash	Potential for ground-water contamination Potential poor tilth and compaction Water table
645:	
Espelie	Potential for ground-water contamination Water table Wind erosion
647:	
Hilaire	Excessive permeability Potential for ground-water contamination Wind erosion
648:	
Newfolden	Potential for ground-water contamination Potential for surface-water contamination

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
649:	
Reiner	Excessive permeability Potential for ground-water contamination Wind erosion
650:	
Reiner	Potential for ground-water contamination Wind erosion
651:	
Thiefriver	Excessive permeability Lime content Potential for ground-water contamination Water table Wind erosion
652:	
Wyandotte	Excessive permeability Lime content Limited available water capacity Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
653:	
Smiley	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
708:	
Rushlake	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
712:	
Rosewood	Excessive permeability Lime content Limited available water capacity Potential for ground-water contamination Water table Wind erosion
713:	
Linveldt	Excessive permeability Potential for ground-water contamination Wind erosion
721B:	
Corliss	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
765:	
Smiley	Potential for ground-water contamination Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
794:	
Clearriver	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion
935:	
Hegne	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table
Fargo	Potential for ground-water contamination Potential poor tilth and compaction Water table
936:	
Clearwater	Potential for ground-water contamination Water table
Reis	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
937:	
Eaglepoint	Lime content Potential for ground-water contamination Potential poor tilth and compaction Restricted permeability Water table
Northcote	Potential for ground-water contamination Potential poor tilth and compaction Water table
972:	
Roliss	Lime content Potential for ground-water contamination Water table Wind erosion
Vallers	Lime content Potential for ground-water contamination Water table Wind erosion
1006:	
Fluvaquents	Flooding Potential for ground-water contamination Potential for surface-water contamination Water table
Haploborolls	Potential for ground-water contamination Potential for surface-water contamination Slope Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1030:	
Pits	Nonsoil material
Udipsamments	Nonsoil material
1031:	
Seelyeville	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1143:	
Berner	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
Markey	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1144:	
Strathcona	Excessive permeability Lime content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
Kratka	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1146:	
Northwood	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1158:	
Skagen	Lime content Potential for ground-water contamination Potential for surface-water contamination Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1170:	
Skagen	Lime content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
1187:	
Dora	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Water table
1188:	
Wildwood	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Water table Wind erosion
1189:	
Clearwater	Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1191:	
Sahkahtay	Excessive permeability Limited available water capacity Potential for ground-water contamination Water table Wind erosion
1264:	
Ulen	Excessive permeability Lime content Limited available water capacity Potential for ground-water contamination Wind erosion
1297:	
Augsburg	Lime content Potential for ground-water contamination Restricted permeability Water table Wind erosion
1299:	
Borup	Lime content Potential for ground-water contamination Water table Wind erosion
1304A:	
Glyndon	Lime content Potential for ground-water contamination Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1304B:	
Glyndon	Lime content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
1315A:	
Wheatville	Lime content Potential for ground-water contamination Wind erosion
1804:	
Hamre	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1807:	
Cathro	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
1808:	
Markey	Excessive permeability High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1871:	
Fargo	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
1874:	
Radium	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
1878:	
Hamre	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1882:	
Rosewood	Excessive permeability Lime content Limited available water capacity Potential for ground-water contamination Water table Wind erosion
Strathcona	Excessive permeability Lime content Potential for ground-water contamination Water table Wind erosion
Berner	Excessive permeability High organic matter content Potential for ground-water contamination Water table Wind erosion
1963:	
Bearden	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
Colvin	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
1964:	
Colvin	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
Fargo	Potential for ground-water contamination Potential poor tilth and compaction Water table
1966:	
Rosewood	Excessive permeability Lime content Limited available water capacity Potential for ground-water contamination Water table Wind erosion
Hamar	Limited available water capacity Potential for ground-water contamination Water table Wind erosion

Land Capability and Yields per Acre of Crops and Pasture

(Yields in the "N" columns are for nonirrigated areas; those in the "I" column are for irrigated areas. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability		Alfalfa hay		Barley		Bromegrass-alfalfa		Oats		Sugar beets		Sunflowers		Spring wheat	
	N	I	N	I	N	I	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	AUM*	AUM*	Bu	Bu	Tons	Tons	Lbs	Lbs	Bu	Bu
47--------------- Colvin	2w	---	---	---	90.0	---	---	---	110.0	---	18.0	---	2,200	---	50	---
57A-------------- Fargo	2w	---	---	---	80.0	---	---	---	100.0	---	15.0	---	1,900	---	40.0	---
58--------------- Kittson	1	---	5.0	---	95.0	---	6.5	---	100.0	---	18.0	---	2,300	---	55.0	---
59--------------- Grimstad	2s	---	4.7	---	85.0	---	6.1	---	95.0	---	---	---	1,700	---	40.0	---
65--------------- Foxhome	3s	---	4.4	---	65.0	---	5.7	---	75.0	---	---	---	1,500	---	30.0	---
66--------------- Flaming	4s	---	4.3	---	65.0	---	5.6	---	75.0	---	---	---	1,000	---	30.0	---
67A-------------- Bearden	2s	---	---	---	100.0	---	---	---	120.0	---	20.0	---	2,400	---	60.0	---
67B-------------- Bearden	2e	---	---	---	95.0	---	---	---	115.0	---	18.0	---	2,200	---	55.0	---
77--------------- Garnes	1	---	4.9	---	85.0	---	6.4	---	90.0	---	---	---	2,100	---	45.0	---
93A-------------- Bearden	2s	---	---	---	100.0	---	---	---	120.0	---	20.0	---	2,400	---	60.0	---
111-------------- Hangaard	4w	---	---	---	40.0	---	---	---	85.0	---	---	---	1,200	---	25.0	---
116-------------- Redby	3w	---	---	---	40.0	---	---	---	60.0	---	---	---	800	---	23.0	---
117-------------- Cormant	4w	---	---	---	55.0	---	---	---	65.0	---	---	---	1,300	---	25.0	---

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability		Alfalfa hay		Barley		Bromegrass-alfalfa		Oats		Sugar beets		Sunflowers		Spring wheat	
	N	I	N	I	N	I	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	AUM*	AUM*	Bu	Bu	Tons	Tons	Lbs	Lbs	Bu	Bu
145-------------- Enstrom	4s	---	4.3	---	65.0	---	5.6	---	75.0	---	---	---	1,400	---	20.0	---
148-------------- Poppleton	4s	---	4.2	---	35.0	---	5.5	---	45.0	---	---	---	800	---	20.0	---
157A------------- Wahpeton	2s	---	---	---	95.0	---	---	---	120.0	---	17.0	---	2,250	---	43.0	---
157B------------- Wahpeton	2e	---	---	---	90.0	---	---	---	110.0	---	15.0	---	2,100	---	38.0	---
184A------------- Hamerly	2s	---	4.8	---	90.0	---	6.2	---	100.0	---	18.0	---	2,100	---	47.0	---
187:																
Haug, drained---	4w	---	---	---	30.0	---	---	---	25.0	---	---	---	750	---	20.0	---
Haug, undrained-	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
205-------------- Karlstad	3s	---	4.3	---	60.0	---	5.6	---	55.0	---	---	---	1,000	---	25.0	---
236-------------- Vallers	2w	---	3.7	---	75.0	---	4.8	---	85.0	---	16.0	---	1,900	---	40.0	---
242B------------- Marquette	4s	---	3.1	---	40.0	---	4.0	---	45.0	---	---	---	800	---	20.0	---
258B------------- Sandberg	4s	4s	3.0	---	40.0	---	3.9	---	40.0	---	---	---	800	---	20.0	---
280-------------- Pelan	3s	---	4.4	---	65.0	---	5.7	---	80.0	---	---	---	1,000	---	30.0	---
372-------------- Hamar	4w	---	2.4	---	45.0	---	3.1	---	75.0	---	---	---	1,300	---	25.0	---
379-------------- Percy	2w	---	3.6	---	60.0	---	4.7	---	65.0	---	---	---	1,700	---	30.0	---
383-------------- Percy	2w	---	3.8	---	75.0	---	5.0	---	80.0	---	---	---	1,900	---	40.0	---

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability		Alfalfa hay		Barley		Bromegrass-alfalfa		Oats		Sugar beets		Sunflowers		Spring wheat	
	N	I	N	I	N	I	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	AUM*	AUM*	Bu	Bu	Tons	Tons	Lbs	Lbs	Bu	Bu
384--------------- Percy	3w	---	---	---	40.0	---	---	---	50.0	---	---	---	1,000	---	25.0	---
387--------------- Roliss	3w	---	---	---	40.0	---	---	---	50.0	---	---	---	1,000	---	25.0	---
412--------------- Mavie	3w	---	2.6	---	60.0	---	3.6	---	75.0	---	---	---	1,400	---	30.0	---
418--------------- Lamoure	2w	---	---	---	90.0	---	---	---	75.0	---	15.0	---	2,000	---	35.0	---
426--------------- Foldahl	3s	---	4.5	---	75.0	---	5.9	---	75.0	---	15.0	---	1,600	---	35.0	---
429A-------------- Northcote	2w	---	---	---	75.0	---	---	---	90.0	---	15.0	---	1,800	---	40.0	---
432--------------- Strandquist	3w	---	2.6	---	60.0	---	3.6	---	75.0	---	---	---	1,400	---	30.0	---
435--------------- Syrene	4w	---	---	---	55.0	---	---	---	65.0	---	---	---	1,300	---	25.0	---
439--------------- Strathcona	2w	---	3.9	---	70.0	---	5.1	---	80.0	---	15.0	---	1,800	---	40.0	---
481--------------- Kratka	3w	---	2.7	---	65.0	---	3.5	---	80.0	---	---	---	1,600	---	40.0	---
482--------------- Grygla	4w	---	---	---	55.0	---	---	---	65.0	---	---	---	1,300	---	25.0	---
514--------------- Tacoosh	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
540--------------- Seelyeville	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
541--------------- Rifle	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability		Alfalfa hay		Barley		Bromegrass-alfalfa		Oats		Sugar beets		Sunflowers		Spring wheat	
	N	I	N	I	N	I	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	AUM*	AUM*	Bu	Bu	Tons	Tons	Lbs	Lbs	Bu	Bu
543:																
Markey, drained	4w	---	---	---	30.0	---	---	---	25.0	---	---	---	750	---	20.0	---
Markey, undrained	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
544:																
Cathro, drained	4w	---	---	---	30.0	---	---	---	25.0	---	---	---	750	---	20.0	---
Cathro, undrained	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
546 Lupton	7w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
547:																
Deerwood, drained	4w	---	---	---	30.0	---	---	---	25.0	---	---	---	750	---	20.0	---
Deerwood, undrained	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
550 Dora	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
563:																
Northwood, drained	4w	---	---	---	30.0	---	---	---	25.0	---	---	---	750	---	20.0	---
Northwood, undrained	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
565 Eckvoll	3s	---	4.5	---	70.0	---	5.9	---	75.0	---	---	---	1,500	---	30.0	---
582 Roliss	2w	---	3.7	---	75.0	---	4.8	---	90.0	---	16.0	---	1,900	---	45.0	---
583 Nereson	1	---	5.0	---	90.0	---	6.5	---	95.0	---	---	---	2,100	---	48.0	---
630 Wildwood	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability		Alfalfa hay		Barley		Bromegrass-alfalfa		Oats		Sugar beets		Sunflowers		Spring wheat	
	N	I	N	I	N	I	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	AUM*	AUM*	Bu	Bu	Tons	Tons	Lbs	Lbs	Bu	Bu
641-------------- Clearwater	2w	---	3.5	---	75.0	---	4.6	---	90.0	---	15.0	---	1,800	---	45.0	---
642-------------- Clearwater	2w	---	3.6	---	80.0	---	4.7	---	95.0	---	16.0	---	1,900	---	50.0	---
643-------------- Huot	2s	---	4.7	---	85.0	---	6.1	---	95.0	---	17.0	---	2,000	---	40.0	---
644-------------- Boash	2w	---	3.5	---	75.0	---	4.6	---	90.0	---	15.0	---	1,800	---	45.0	---
645-------------- Espelie	2w	---	3.8	---	80.0	---	5.0	---	90.0	---	15.0	---	1,600	---	35.0	---
647-------------- Hilaire	3s	---	4.5	---	75.0	---	5.9	---	80.0	---	16.0	---	1,700	---	35.0	---
648-------------- Newfolden	2s	---	4.9	---	95.0	---	6.4	---	110.0	---	---	---	2,300	---	50.0	---
649-------------- Reiner	2s	---	4.9	---	90.0	---	6.4	---	100.0	---	---	---	2,100	---	45.0	---
650-------------- Reiner	1	---	5.0	---	95.0	---	6.5	---	110.0	---	---	---	2,300	---	50.0	---
651-------------- Thiefriver	2w	---	3.8	---	80.0	---	5.0	---	85.0	---	15.0	---	1,800	---	35.0	---
652-------------- Wyandotte	3w	---	2.5	---	60.0	---	3.3	---	75.0	---	---	---	1,400	---	30.0	---
653-------------- Smiley	3w	---	---	---	35.0	---	---	---	60.0	---	---	---	1,300	---	25.0	---
708-------------- Rushlake	4s	---	4.2	---	35.0	---	5.5	---	50.0	---	---	---	950	---	23.0	---
712-------------- Rosewood	3w	---	2.8	---	60.0	---	3.6	---	75.0	---	---	---	1,400	---	30.0	---
713-------------- Linveldt	3s	---	4.5	---	70.0	---	5.9	---	85.0	---	---	---	1,800	---	40.0	---
721B------------- Corliss	4s	---	3.0	---	25.0	---	3.9	---	35.0	---	---	---	800	---	18.0	---

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability		Alfalfa hay		Barley		Bromegrass-alfalfa		Oats		Sugar beets		Sunflowers		Spring wheat	
	N	I	N	I	N	I	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	AUM*	AUM*	Bu	Bu	Tons	Tons	Lbs	Lbs	Bu	Bu
765-------------- Smiley	2w	---	4.0	---	85.0	---	5.2	---	90.0	---	---	---	2,000	---	47.0	---
794-------------- Clearriver	4s	---	4.3	---	30.0	---	5.6	---	40.0	---	---	---	1,000	---	25.0	---
935-------------- Hegne-Fargo	2w	---	---	---	75.0	---	---	---	95.0	---	15.0	---	1,900	---	40.0	---
936-------------- Clearwater-Reis	2w	---	3.6	---	80.0	---	4.7	---	90.0	---	16.0	---	1,900	---	50.0	---
937-------------- Eaglepoint- Northcote	2w	---	---	---	75.0	---	---	---	85.0	---	15.0	---	1,800	---	31.0	---
972-------------- Roliss-Vallers	2w	---	3.7	---	75.0	---	4.8	---	90.0	---	16.0	---	1,900	---	45.0	---
1006--------------			---	---	---	---	---	---	---	---	---	---	---	---	---	---
Fluvaquents------	6w	---														
Haploborolls----	6e	---														
1030------------- Pits- Udipsamments	8s	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1031------------- Seelyeville	8w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1143------------- Berner-Markey	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1144-------------			---	---	40.0	---	---	---	50.0	---	---	---	1,000	---	25.0	---
Strathcona-------	3w	---														
Kratka-----------	4w	---														
1146------------- Northwood	8w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1158------------- Skagen	2e	---	4.8	---	85.0	---	6.2	---	90.0	---	---	---	2,100	---	47.0	---
1170------------- Skagen	2e	---	4.6	---	70.0	---	6.0	---	80.0	---	---	---	1,900	---	37.0	---

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability		Alfalfa hay		Barley		Bromegrass-alfalfa		Oats		Sugar beets		Sunflowers		Spring wheat	
	N	I	N	I	N	I	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	AUM*	AUM*	Bu	Bu	Tons	Tons	Lbs	Lbs	Bu	Bu
1187------------- Dora	8w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1188------------- Wildwood	8w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1189------------- Clearwater	3w	---	---	---	35.0	---	---	---	55.0	---	---	---	1,200	---	25.0	---
1191------------- Sahkahtay	3w	---	3.0	---	40.0	---	3.9	---	60.0	---	---	---	1,200	---	20.0	---
1264------------- Ulen	3s	---	4.3	---	65.0	---	5.6	---	80.0	---	---	---	1,300	---	30.0	---
1297------------- Augsburg	2w	---	---	---	80.0	---	---	---	110.0	---	18.0	---	2,100	---	50.0	---
1299------------- Borup	2w	---	---	---	80.0	---	---	---	110.0	---	18.0	---	2,100	---	50.0	---
1304A------------ Glyndon	2s	---	---	---	100.0	---	---	---	120.0	---	19.0	---	2,400	---	60.0	---
1304B------------ Glyndon	2e	---	---	---	95.0	---	---	---	115.0	---	17.0	---	2,200	---	55.0	---
1315A------------ Wheatville	2s	---	---	---	100.0	---	---	---	120.0	---	19.0	---	2,400	---	60.0	---
1804------------- Hamre	8w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1807------------- Cathro	8w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1808------------- Markey	8w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1871------------- Fargo	3w	---	---	---	25.0	---	---	---	30.0	---	13.0	---	1,200	---	20.0	---
1874------------- Radium	4s	---	4.2	---	50.0	---	5.5	---	50.0	---	---	---	1,400	---	25.0	---

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability		Alfalfa hay		Barley		Bromegrass-alfalfa		Oats		Sugar beets		Sunflowers		Spring wheat	
	N	I	N	I	N	I	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	AUM*	AUM*	Bu	Bu	Tons	Tons	Lbs	Lbs	Bu	Bu
1878:																
Hamre, drained--	3w	---	---	---	30.0	---	---	---	25.0	---	---	---	750	---	20.0	---
Hamre, undrained	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1882------------- Rosewood- Strathcona- Berner	6w	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1963-------------			---	---	100.0	---	---	---	120.0	---	20.0	---	2,400	---	60.0	---
Bearden---------	2s	---														
Colvin----------	2w	---														
1964------------- Colvin-Fargo	2w	---	---	---	90.0	---	---	---	110.0	---	18.0	---	2,200	---	50.0	---
1966-------------			2.8	---	65.0	---	3.6	---	80.0	---	---	---	1,400	---	35.0	---
Rosewood--------	3w	---														
Hamar-----------	4w	---														

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
47	Colvin silty clay loam (where drained)
57A	Fargo silty clay, 0 to 2 percent slopes (where drained)
58	Kittson loam
59	Grimstad fine sandy loam
67A	Bearden silt loam, 0 to 2 percent slopes
67B	Bearden silt loam, 2 to 6 percent slopes
77	Garnes fine sandy loam
93A	Bearden silty clay loam, 0 to 2 percent slopes
157A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded
157B	Wahpeton silty clay, 2 to 6 percent slopes, occasionally flooded
184A	Hamerly loam, 0 to 3 percent slopes
236	Vallers loam (where drained)
383	Percy loam (where drained)
418	Lamoure silty clay loam, occasionally flooded (where drained)
429A	Northcote clay, 0 to 2 percent slope (where drained)
439	Strathcona fine sandy loam (where drained)
481	Kratka fine sandy loam (where drained)
582	Roliss loam (where drained)
583	Nereson fine sandy loam
641	Clearwater clay (where drained)
642	Clearwater loam (where drained)
643	Huot fine sandy loam
644	Boash clay loam (where drained)
645	Espelie fine sandy loam (where drained)
648	Newfolden loam
649	Reiner loamy fine sand
650	Reiner fine sandy loam
651	Thiefriver fine sandy loam (where drained)
713	Linveldt fine sandy loam
765	Smiley loam (where drained)
935	Hegne-Fargo complex (where drained)
936	Clearwater-Reis complex (where drained)
937	Eaglepoint-Northcote complex (where drained)
972	Roliss-Vallers complex (where drained)
1158	Skagen loam
1297	Augsburg very fine sandy loam (where drained)
1299	Borup very fine sandy loam (where drained)
1304A	Glyndon very fine sandy loam, 0 to 2 percent slopes
1304B	Glyndon very fine sandy loam, 2 to 6 percent slopes
1315A	Wheatville very fine sandy loam, 0 to 2 percent slopes
1963	Bearden-Colvin complex (where drained)
1964	Colvin-Fargo complex (where drained)

Windbreaks and Environmental Plantings

(Only the soils suitable for windbreaks and environmental plantings are listed. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
47:					
Colvin----------	---	Siberian peashrub, redosier dogwood, American plum, lilac, common chokecherry.	Manchurian crabapple, white spruce, blue spruce.	Golden willow-----	Carolina poplar, eastern cottonwood.
57A:					
Fargo-----------	---	Siberian peashrub, redosier dogwood, eastern redcedar, American plum, lilac, common chokecherry.	Green ash, Siberian crabapple, Black Hills spruce.	Golden willow-----	Eastern cottonwood.
58:					
Kittson---------	---	Siberian peashrub, Peking cotoneaster, redosier dogwood, eastern redcedar, Tatarian honeysuckle, American plum, common chokecherry.	Green ash, Manchurian crabapple, white spruce, Black Hills spruce, ponderosa pine, blue spruce.	Golden willow-----	Eastern cottonwood.
59:					
Grimstad--------	Lilac-------------	Siberian peashrub, eastern redcedar, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
65:					
Foxhome---------	Siberian peashrub, Tatarian honeysuckle, silver buffaloberry, lilac.	Russian-olive, green ash, eastern redcedar, Siberian crabapple, Manchurian crabapple, common chokecherry.	Jack pine, ponderosa pine, red pine, Siberian elm.	---	---
66:					
Flaming---------	---	Siberian peashrub, Peking cotoneaster, redosier dogwood, eastern redcedar, Tatarian honeysuckle, American plum, common chokecherry.	Manchurian crabapple, white spruce, blue spruce.	Golden willow-----	Eastern cottonwood.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
67A:					
Bearden----------	---	Siberian peashrub, American plum, lilac.	Eastern redcedar, Siberian crabapple, ponderosa pine, blue spruce.	Hackberry, green ash, golden willow.	Eastern cottonwood, Siberian elm.
67B:					
Bearden----------	---	Siberian peashrub, American plum, lilac.	Eastern redcedar, Siberian crabapple, ponderosa pine, blue spruce.	Hackberry, green ash, golden willow.	Eastern cottonwood, Siberian elm.
77:					
Garnes-----------	Peking cotoneaster	Siberian peashrub, redosier dogwood, American plum, lilac, common chokecherry, American cranberrybush.	Eastern redcedar, Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, jack pine, red pine, eastern white pine, golden willow.	Eastern cottonwood.
93A:					
Bearden----------	---	Siberian peashrub, American plum, lilac.	Eastern redcedar, Siberian crabapple, ponderosa pine, blue spruce.	Hackberry, green ash, golden willow.	Eastern cottonwood, Siberian elm.
111:					
Hangaard---------	---	Siberian peashrub, eastern redcedar, Tatarian honeysuckle, lilac, common chokecherry.	Russian-olive, Manchurian crabapple, white spruce, blue spruce, bur oak, northern whitecedar.	Green ash, golden willow, Siberian elm.	Eastern cottonwood.
116:					
Redby------------	---	Siberian peashrub, redosier dogwood, lilac, American cranberrybush.	Russian-olive, white spruce, blue spruce.	Hackberry, green ash, Norway spruce, jack pine, red pine.	---
117:					
Cormant----------	---	Siberian peashrub, redosier dogwood, American plum, lilac, common chokecherry, American cranberrybush.	Manchurian crabapple, white spruce, blue spruce, northern whitecedar.	Green ash, Norway spruce, eastern white pine, golden willow.	Silver maple, Carolina poplar, eastern cottonwood.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
145:					
Enstrom	---	Siberian peashrub, Peking cotoneaster, redosier dogwood, eastern redcedar, Tatarian honeysuckle, American plum, lilac, common chokecherry.	Green ash, Manchurian crabapple, Norway spruce, jack pine, white spruce, blue spruce, red pine.	Golden willow	Eastern cottonwood.
148:					
Poppleton	---	Siberian peashrub, Peking cotoneaster, redosier dogwood, eastern redcedar, Tatarian honeysuckle, American plum, lilac, common chokecherry.	Green ash, Manchurian crabapple, Norway spruce, jack pine, white spruce, blue spruce, red pine.	Golden willow	Eastern cottonwood.
157A:					
Wahpeton	---	Siberian peashrub, Peking cotoneaster, redosier dogwood, eastern redcedar, Siberian crabapple, ponderosa pine, American plum, lilac, common chokecherry.	Russian-olive, green ash, Black Hills spruce, bur oak.	Golden willow	Eastern cottonwood.
157B:					
Wahpeton	---	Siberian peashrub, Peking cotoneaster, redosier dogwood, eastern redcedar, Siberian crabapple, ponderosa pine, American plum, lilac, common chokecherry.	Russian-olive, green ash, Black Hills spruce, bur oak.	Golden willow	Eastern cottonwood.
184A:					
Hamerly	---	Siberian peashrub, Peking cotoneaster, redosier dogwood, eastern redcedar, Siberian crabapple, ponderosa pine, blue spruce, American plum, lilac, common chokecherry.	Hackberry, green ash, Black Hills spruce.	Golden willow	Eastern cottonwood, Siberian elm.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
205:					
Karlstad	Lilac	Siberian peashrub, eastern redcedar, common chokecherry, northern whitecedar.	Russian-olive, green ash, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
236:					
Vallers	Redosier dogwood	Siberian peashrub, eastern redcedar, American plum, lilac, common chokecherry.	Russian-olive, green ash, Siberian crabapple, white spruce, Black Hills spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
242B:					
Marquette	Siberian peashrub, Rocky Mountain juniper, silver buffaloberry, lilac.	Russian-olive, eastern redcedar, sargent crabapple, blue spruce, common chokecherry, late lilac.	Silver maple, green ash, white spruce, Black Hills spruce, ponderosa pine, red pine, Scotch pine.	Eastern cottonwood, Siberian elm.	---
258B:					
Sandberg	---	Siberian peashrub, eastern redcedar, sargent crabapple, Black Hills spruce, lilac, common chokecherry.	Silver maple, Russian-olive, green ash, ponderosa pine, Scotch pine.	Eastern cottonwood	---
280:					
Pelan	---	Siberian peashrub, eastern redcedar, Manchurian crabapple, American plum, common chokecherry, silver buffaloberry, lilac.	Amur maple, Russian-olive, green ash, Norway spruce, white spruce, ponderosa pine, blue spruce, red pine, bur oak.	Jack pine, Siberian elm.	---
372:					
Hamar	Silver buffaloberry, lilac.	Siberian peashrub, redosier dogwood, American plum, common chokecherry.	Hackberry, eastern redcedar, Siberian crabapple, Black Hills spruce, ponderosa pine, blue spruce.	Green ash, golden willow.	Eastern cottonwood.
379:					
Percy	Redosier dogwood	Siberian peashrub, lilac, common chokecherry.	Russian-olive, eastern redcedar, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
383:					
Percy	Redosier dogwood	Siberian peashrub, lilac, common chokecherry.	Russian-olive, eastern redcedar, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
412:					
Mavie	---	Siberian peashrub, eastern redcedar, lilac, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
418:					
Lamoure	Redosier dogwood, silver buffaloberry, lilac.	Siberian peashrub, American plum, common chokecherry.	Hackberry, eastern redcedar, Manchurian crabapple, Black Hills spruce, ponderosa pine, blue spruce.	Green ash, golden willow.	Eastern cottonwood.
426:					
Foldahl	---	Siberian peashrub, Peking cotoneaster, redosier dogwood, eastern redcedar, Tatarian honeysuckle, American plum, common chokecherry.	Manchurian crabapple, white spruce, blue spruce.	Golden willow	Eastern cottonwood.
429A:					
Northcote	---	Siberian peashrub, redosier dogwood, American plum, lilac, common chokecherry.	Manchurian crabapple, white spruce, blue spruce.	Golden willow	Carolina poplar, eastern cottonwood.
432:					
Strandquist	---	Siberian peashrub, eastern redcedar, common chokecherry, lilac, northern whitecedar.	Russian-olive, green ash, Manchurian crabapple, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
435:					
Syrene	---	Siberian peashrub, eastern redcedar, lilac, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
439:					
Strathcona	---	Siberian peashrub, redosier dogwood, eastern redcedar, common chokecherry, lilac, northern whitecedar.	Green ash, white spruce, blue spruce.	Golden willow	Eastern cottonwood, Siberian elm.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
481:					
Kratka	---	Siberian peashrub, eastern redcedar, lilac, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak, northern whitecedar.	Hackberry, green ash, golden willow, Siberian elm.	Eastern cottonwood.
482:					
Grygla	---	Siberian peashrub, redosier dogwood, common ninebark, American plum, lilac, common chokecherry, American cranberrybush.	Manchurian crabapple, Norway spruce, white spruce, blue spruce, northern whitecedar.	Green ash, eastern white pine, golden willow.	Silver maple, Carolina poplar, eastern cottonwood.
565:					
Eckvoll	---	Siberian peashrub, Peking cotoneaster, redosier dogwood, eastern redcedar, American plum, common chokecherry, lilac, northern whitecedar.	Green ash, Manchurian crabapple, jack pine, white spruce, blue spruce, red pine.	Golden willow	Eastern cottonwood.
582:					
Roliss	---	Siberian peashrub, cotoneaster, eastern redcedar, common chokecherry, lilac, northern whitecedar.	Russian-olive, green ash, Manchurian crabapple, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
583:					
Nereson	Lilac	Siberian peashrub, eastern redcedar, common chokecherry, northern whitecedar.	Hackberry, Russian-olive, green ash, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
641, 642:					
Clearwater	---	Siberian peashrub, cotoneaster, eastern redcedar, common chokecherry, lilac, northern whitecedar.	Russian-olive, green ash, Manchurian crabapple, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
643:					
Huot	---	Eastern redcedar, lilac, sargent crabapple, blue spruce, common chokecherry.	Russian-olive, white spruce, bur oak.	Hackberry, Siberian elm.	Eastern cottonwood.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
644:					
Boash	---	Siberian peashrub, redosier dogwood, American plum, lilac, common chokecherry.	Manchurian crabapple, white spruce, blue spruce.	Golden willow	Carolina poplar, eastern cottonwood.
645:					
Espelie	---	Siberian peashrub, redosier dogwood, Tatarian honeysuckle, American plum, lilac, common chokecherry.	Manchurian crabapple, white spruce, blue spruce.	Golden willow	Carolina poplar, eastern cottonwood.
647:					
Hilaire	---	Siberian peashrub, Peking cotoneaster, redosier dogwood, eastern redcedar, Tatarian honeysuckle, American plum, common chokecherry.	Manchurian crabapple, white spruce, blue spruce.	Golden willow	Eastern cottonwood.
648:					
Newfolden	Lilac	Siberian peashrub, eastern redcedar, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
649:					
Reiner	Lilac	Siberian peashrub, eastern redcedar, Tatarian honeysuckle, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
650:					
Reiner	Lilac	Siberian peashrub, eastern redcedar, Tatarian honeysuckle, common chokecherry, northern whitecedar.	Russian-olive, green ash, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
651:					
Thiefriver	---	Siberian peashrub, eastern redcedar, lilac, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
652:					
Wyandotte	---	Siberian peashrub, eastern redcedar, lilac, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
708:					
Rushlake	---	Siberian peashrub, silky dogwood, redosier dogwood, lilac, American cranberrybush.	Eastern redcedar, white spruce.	Red maple, silver maple, green ash, Norway spruce, jack pine.	---
712:					
Rosewood	---	Siberian peashrub, eastern redcedar, lilac, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
713:					
Linveldt	Lilac	Siberian peashrub, eastern redcedar, Tatarian honeysuckle, common chokecherry, northern whitecedar.	Russian-olive, green ash, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
721B:					
Corliss	---	Siberian peashrub, eastern redcedar, lilac, sargent crabapple, common chokecherry.	Silver maple, Russian-olive, green ash, Black Hills spruce, ponderosa pine, Scotch pine.	Eastern cottonwood	---
765:					
Smiley	Redosier dogwood, honeysuckle, sargent crabapple, lilac.	Siberian peashrub, gray dogwood, eastern redcedar, American plum, common chokecherry, silver buffaloberry, late lilac, nannyberry viburnum.	---	---	---
794:					
Clearriver	---	Eastern redcedar, honeysuckle, Manchurian crabapple, sargent crabapple, blue spruce, common chokecherry, lilac, silver buffaloberry, late lilac.	Russian-olive, green ash, white spruce, ponderosa pine, Scotch pine, northern whitecedar.	Jack pine, red pine, eastern white pine.	Silver maple, eastern cottonwood, Siberian elm.
935:					
Hegne	---	Siberian peashrub, eastern redcedar, lilac, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
935:					
Fargo	---	Siberian peashrub, redosier dogwood, eastern redcedar, American plum, lilac, common chokecherry.	Green ash, Siberian crabapple, Black Hills spruce.	Golden willow	Eastern cottonwood.
936:					
Clearwater	Redosier dogwood	Siberian peashrub, cotoneaster, eastern redcedar, Siberian crabapple, American plum, lilac, common chokecherry.	Russian-olive, white spruce, Black Hills spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
Reis	Redosier dogwood	Siberian peashrub, cotoneaster, eastern redcedar, Siberian crabapple, American plum, common chokecherry, lilac.	Russian-olive, green ash, white spruce, Black Hills spruce, blue spruce.	Golden willow, Siberian elm.	Eastern cottonwood.
937:					
Eaglepoint	---	Eastern redcedar	Russian-olive, green ash, Siberian crabapple, Black Hills spruce.	---	Siberian elm.
Northcote	---	Siberian peashrub, redosier dogwood, eastern redcedar, American plum, lilac, common chokecherry.	Russian-olive, Siberian crabapple, Manchurian crabapple, white spruce, Black Hills spruce, blue spruce.	Green ash, golden willow, Siberian elm.	Carolina poplar, eastern cottonwood.
972:					
Roliss	---	Siberian peashrub, cotoneaster, eastern redcedar, lilac, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
Vallers	---	Siberian peashrub, eastern redcedar, lilac, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
1006:					
Fluvaquents.					
Haploborolls	---	Siberian peashrub, eastern redcedar, American plum, lilac.	Russian-olive, Siberian crabapple, ponderosa pine, blue spruce, bur oak.	Green ash, honeylocust.	Siberian elm.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
1191:					
Sahkahtay	---	Siberian peashrub, redosier dogwood, American plum, lilac, common chokecherry.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, golden willow.	Silver maple, eastern cottonwood.
1264:					
Ulen	Lilac	Siberian peashrub, eastern redcedar, American plum, common chokecherry, silver buffaloberry.	Russian-olive, Siberian crabapple, white spruce, ponderosa pine, blue spruce, bur oak.	Green ash, golden willow, Siberian elm.	Eastern cottonwood.
1297:					
Augsburg	---	Siberian peashrub, eastern redcedar, lilac, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
1299:					
Borup	Redosier dogwood	Siberian peashrub, eastern redcedar, American plum, lilac, common chokecherry.	Russian-olive, green ash, Siberian crabapple, white spruce, Black Hills spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
1304A:					
Glyndon	Lilac	Siberian peashrub, eastern redcedar, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
1304B:					
Glyndon	Lilac	Siberian peashrub, eastern redcedar, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
1315A:					
Wheatville	Lilac	Siberian peashrub, eastern redcedar, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
1874:					
Radium	Lilac	Siberian peashrub, common chokecherry.	Russian-olive, green ash, white spruce, Black Hills spruce, red pine.	Eastern cottonwood, Siberian elm.	---
1963:					
Bearden	---	Siberian peashrub, American plum, lilac.	Eastern redcedar, Siberian crabapple, ponderosa pine, blue spruce.	Hackberry, green ash, golden willow.	Eastern cottonwood, Siberian elm.

Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
1963:					
Colvin----------	---	Siberian peashrub, redosier dogwood, American plum, lilac, common chokecherry.	Manchurian crabapple, white spruce, blue spruce.	Golden willow-----	Carolina poplar, eastern cottonwood.
1964:					
Colvin----------	---	Siberian peashrub, redosier dogwood, American plum, lilac, common chokecherry.	Manchurian crabapple, white spruce, blue spruce.	Golden willow-----	Carolina poplar, eastern cottonwood.
Fargo-----------	---	Siberian peashrub, redosier dogwood, eastern redcedar, American plum, lilac, common chokecherry.	Green ash, Siberian crabapple, Black Hills spruce.	Golden willow-----	Eastern cottonwood.
1966:					
Rosewood--------	---	Siberian peashrub, eastern redcedar, lilac, common chokecherry.	Russian-olive, white spruce, blue spruce, bur oak.	Golden willow, Siberian elm.	Eastern cottonwood.
Hamar-----------	Silver buffaloberry, lilac.	Siberian peashrub	Hackberry, eastern redcedar, Siberian crabapple, ponderosa pine, blue spruce.	Green ash, golden willow.	Eastern cottonwood.

Windbreak Suitability Groups

(See text for a description of the characteristics of the soils in each group)

Map symbol and soil name	Windbreak suitability group
47:	
Colvin	2K
57A:	
Fargo	2
58:	
Kittson	1
59:	
Grimstad	1K
65:	
Foxhome	5
66:	
Flaming	1
67A, 67B:	
Bearden	1K
77:	
Garnes	1
93A:	
Bearden	1K
111:	
Hangaard	2
116:	
Redby	1
117:	
Cormant	2
145:	
Enstrom	1
148:	
Poppleton	1
157A, 157B:	
Wahpeton	1
184A:	
Hamerly	1K
187:	
Haug	10
205:	
Karlstad	1
236:	
Vallers	2K
242B:	
Marquette	7

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
258B:	
Sandberg	7
280:	
Pelan	5
372:	
Hamar	2
379, 383:	
Percy	2K
384:	
Percy	2W
387:	
Roliss	2W
412:	
Mavie	2K
418:	
Lamoure	2K
426:	
Foldahl	1
429A:	
Northcote	2
432:	
Strandquist	2K
435:	
Syrene	2K
439:	
Strathcona	2K
481:	
Kratka	2
482:	
Grygla	2
514:	
Tacoosh	2H
540:	
Seelyeville	10
541:	
Rifle	10
543:	
Markey	10
544:	
Cathro	10
546:	
Lupton	10

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
547:	
Deerwood	10
550:	
Dora	10
563:	
Northwood	10
565:	
Eckvoll	1
582:	
Roliss	2K
583:	
Nereson	1
630:	
Wildwood	10
641, 642:	
Clearwater	2K
643:	
Huot	1K
644:	
Boash	2
645:	
Espelie	2
647:	
Hilaire	1
648:	
Newfolden	1
649, 650:	
Reiner	1
651:	
Thiefriver	2K
652:	
Wyandotte	2K
653:	
Smiley	2W
708:	
Rushlake	1
712:	
Rosewood	2K
713:	
Linveldt	1
721B:	
Corliss	7

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
765:	
Smiley	2
794:	
Clearriver	7
935:	
Hegne	2K
Fargo	2
936:	
Clearwater	2K
Reis	2K
937:	
Eaglepoint	2K
Northcote	2
972:	
Roliss	2K
Vallers	2K
1006:	
Fluvaquents	10
Haploborolls	3
1030:	
Pits.	
Udipsamments.	
1031:	
Seelyeville	10
1143:	
Berner	10
Markey	10
1144:	
Strathcona	2W
Kratka	2W
1146:	
Northwood	10
1158, 1170:	
Skagen	1K
1187:	
Dora	10
1188:	
Wildwood	10
1189:	
Clearwater	10

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
1191:	
Sahkahtay	2
1264:	
Ulen	1K
1297:	
Augsburg	2K
1299:	
Borup	2K
1304A, 1304B:	
Glyndon	1K
1315A:	
Wheatville	1K
1804:	
Hamre	10
1807:	
Cathro	10
1808:	
Markey	10
1871:	
Fargo	2
1874:	
Radium	1
1878:	
Hamre	10
1882:	
Rosewood	10
Strathcona	10
Berner	10
1963:	
Bearden	1K
Colvin	2K
1964:	
Colvin	2K
Fargo	2
1966:	
Rosewood	2K
Hamar	2

Forest Land

About 10 percent of Marshall County is forested. The wooded areas are primarily in the eastern two-thirds of the county. The most common tree species are aspen, birch, and oak. Some of the wetter mineral soils and organic soils support black spruce, tamarack, and black ash.

Most wooded areas are used for wildlife habitat or pasture. Few areas are commercially logged. Tree removal is primarily for firewood. There are a few small Christmas tree plantations. In areas of sparse tree growth or in other cleared areas, trees can be planted for commercial use, for firewood, for esthetic purposes, or for wildlife.

Forest Land Management Considerations

Information about the hazards and limitations that should be considered in areas used as forest land are given in the tables "Forest Land Harvest Equipment Considerations," "Forest Haul Road Considerations," "Forest Log Landing Considerations," and "Forest Land Site Preparation and Planting Considerations."

Forest Land Harvest Equipment Considerations

For most soils spring is the most limiting season. Alternate thawing and freezing during snowmelt cause saturation and low strength of the surface soil layers. When thawing is complete, saturation continues for short periods in well drained soils to nearly all year in very poorly drained depressional soils. Degrees of wetness are generally proportionate to water table height and duration. The water table generally is lower in the summer during the heavy use of moisture by vegetation and is nearer the surface during periods when absorbed precipitation is greater than the vegetation requires. Harvesting during periods of saturation usually results in severe soil damage, except when the soil is frozen. The preferred season for timber harvest on many soils is winter, when wetness and low soil strength can be overcome by freezing.

Considerations shown in the table are as follows:

Slope.—The upper slope limit is more than 15 percent.

Flooding.—The map unit component is frequently flooded.

Wetness.—The map unit component is somewhat poorly drained, poorly drained, or very poorly drained or has a perched water table (any drainage class).

Depth to hard rock.—The depth to hard bedrock is less than 10 inches.

Rubbly surface.—The word "rubbly" is in the map unit name.

Surface stones.—The words "extremely stony" are in the map unit name.

Surface boulders.—The word "bouldery" is in the map unit name.

Areas of rock outcrop.—The words "Rock outcrop" are in the map unit name.

Susceptible to rutting and wheel slippage (low strength).—The AASHTO classification is A-6, A-7, or A-8 in any layer at a depth of 20 inches or less.

Poor traction (loose sandy material).—The USDA texture includes sands or loamy sands in any layer at a depth of 10 inches or less.

Forest Haul Road Considerations

Haul roads serve as transportation routes from log landings to primary roads. Generally, haul roads are unpaved, but some are graveled.

Considerations shown in the table are as follows:

Slope.—The slope is 8 percent or more.

Flooding.—The map unit component is frequently flooded.

Wetness.—The map unit component is somewhat poorly drained, poorly drained, or very poorly drained or has a perched water table (any drainage class).

Depth to hard rock.—The depth to hard bedrock is less than 20 inches.

Depth to soft rock.—The depth to soft bedrock is less than 20 inches.

Surface boulders.—The word "bouldery" is in the map unit name.

Areas of rock outcrop.—The words "Rock outcrop" are in the map unit name.

Low bearing strength.—The AASHTO classification is A-6, A-7, or A-8 in any layer at a depth of 20 inches or less.

Rubbly surface.—The word "rubbly" is in the map unit name.

Forest Log Landing Considerations

Log landings are areas where logs are assembled for transportation. Areas that require little or no cutting, filling, or surface preparation are desired.

Considerations shown in the table are as follows:

Slope.—The slope is more than 3 percent.

Flooding.—The map unit component is occasionally flooded or frequently flooded.

Wetness.—The map unit component is somewhat poorly drained, poorly drained, or very poorly drained or has a perched water table (any drainage class).

Surface boulders.—The word "bouldery" is in the map unit name.

Areas of rock outcrop.—The words "Rock outcrop" are in the map unit name.

Susceptible to rutting and wheel slippage (low strength).—The AASHTO classification is A-6, A-7, or A-8 in any layer at a depth of 20 inches or less.

Rubbly surface.—The word "rubbly" is in the map unit name.

Forest Land Site Preparation and Planting Considerations

Considerations shown in this table are as follows:

Slope.—The upper slope limit is more than 15 percent.

Flooding.—The map unit component is frequently flooded.

Wetness.—The map unit component is somewhat poorly drained, poorly drained, or very poorly drained or has a perched water table (any drainage class).

Depth to hard rock.—The depth to hard bedrock is less than 20 inches.

Surface stones.—The word "stony" is in the map unit name.

Surface boulders.—The word "bouldery" is in the map unit name.

Areas of rock outcrop.—The words "Rock outcrop" are in the map unit name.

Water erosion.—The slope is 8 percent or more.

Potential poor tilth and compaction.—The AASHTO classification is A-6 or A-7 in the upper 10 inches.

Rubbly surface.—The word "rubbly" is in the map unit name.

Cobbly surface.—The word "cobbly" is in the map unit name.

Forest Land Harvest Equipment Considerations

(Only the soils suitable for commercial production of trees are listed. See text for a description of the considerations listed in this table)

Map symbol and soil name	Forest land harvest equipment considerations
77:	
Garnes	Susceptible to rutting and wheel slippage
116:	
Redby	Poor traction (loose sandy material) Wetness
117:	
Cormant	Poor traction (loose sandy material) Wetness
482:	
Grygla	Poor traction (loose sandy material) Wetness
794:	
Clearriver	Poor traction (loose sandy material)

Forest Haul Road Considerations

(Only the soils suitable for commercial production of trees are listed. See text for a description of the considerations listed in this table)

Map symbol and soil name	Forest haul road considerations
77:	
Garnes	Low bearing strength
116:	
Redby	Wetness
117:	
Cormant	Wetness
482:	
Grygla	Wetness
794:	
Clearriver	No major considerations or hazards

Forest Log Landing Considerations

(Only the soils suitable for commercial production of trees are listed. See text for a description of the considerations listed in this table)

Map symbol and soil name	Forest log landing considerations
77:	
Garnes	Susceptible to rutting and wheel slippage
116:	
Redby	Wetness
117:	
Cormant	Wetness
482:	
Grygla	Wetness
794:	
Clearriver	No major considerations or hazards

Forest Land Site Preparation and Planting Considerations

(Only the soils suitable for commercial production of trees are listed. See text for a description of the considerations listed in this table)

Map symbol and soil name	Site preparation and planting considerations
77:	
Garnes	No major considerations or hazards
116:	
Redby	Wetness
117:	
Cormant	Wetness
482:	
Grygla	Wetness
794:	
Clearriver	No major considerations or hazards

Recreation

Glacial Lake Agassiz covered all of the survey area at one time but did not leave behind any of the deep recreational lakes that are abundant elsewhere in Minnesota. Lake Agassiz did leave behind rich, fertile cropland, concentrated in the western part of the county, and large marshy areas for birds and wildlife in the eastern and central parts. Small wooded areas are scattered in the eastern two-thirds of the county.

Many recreational opportunities are available in the county on more than 160,000 acres of publicly owned lands.

Many of the towns in Marshall County have city parks that provide camping and picnicking facilities. Some of the larger towns also have swimming pools, tennis courts, and golf courses for public use.

Florian County Park in central Marshall County has a lake formed by the Tamarac River. In the summer this park provides opportunities for swimming, picnicking, camping, and fishing.

Old Mill State Park, which is 17 miles northeast of Warren, offers much in the way of recreational opportunities. The park is located on partially wooded rises adjacent to the Middle River. Part of the park has been restored to natural prairie. This area supports native grasses and wildflowers. In the summer a swimming beach, hiking trails, picnic areas, and camping areas are open. In the winter, Old Mill is a popular spot for sledding, cross-country skiing, and snowmobiling. Scheduled naturalist activities are held throughout the year, including special times when the old mill is operated.

Hunting is a popular sport in Marshall County. There are several State wildlife areas. Hunting seasons for deer, moose, bear, waterfowl, grouse, and partridge are in the fall.

The Agassiz National Wildlife Refuge is operated by the U.S. Fish and Wildlife Service in east-central Marshall County. Foot and auto trails, a lookout tower, and a visitor center are open seasonally for viewing of birds and wildlife (fig. 2).

A snowmobile trail network is set up throughout the county. Snowmobiling is a very popular winter sport.

The soils of the survey area are rated in the table "Recreational Development" according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites, and either access to public sewer lines or the capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degrees, for recreational uses by the duration of flooding and the season when it occurs. Onsite assessment of the height, duration, intensity, and frequency of flooding is essential in planning recreational facilities.

Camp areas are tracts of land used intensively as sites for tents, trailers, and campers and for outdoor activities that accompany such sites. These areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The soils are rated on the basis of soil properties that influence the ease of developing camp areas and performance of the areas after development. Also considered are the soil properties that influence trafficability and promote the growth of vegetation after heavy use.

Picnic areas are natural or landscaped tracts of land that are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The soils are rated on the basis of soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation after development. The surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Playgrounds are areas used intensively for baseball, football, or similar activities. These areas require a nearly level soil that is free of stones and that can withstand heavy foot traffic and maintain an adequate cover of vegetation. The soils are rated on the basis of soil properties that influence the cost of

Figure 2.—One of several pools in the Agassiz National Wildlife Refuge. The pools provide an abundance of habitat for plants and wildlife.

shaping the site, trafficability, and the growth of vegetation. Slope and stoniness are the main concerns in developing playgrounds. The surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Paths and trails are areas used for hiking and horseback riding. The areas should require little or no cutting and filling during site preparation. The soils are rated on the basis of soil properties that influence trafficability and erodibility. Paths and trails should remain firm under foot traffic and not be dusty when dry.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

The interpretive ratings in this table help engineers, planners, and others to understand how soil properties influence recreational uses. Ratings for proposed uses are given in terms of limitations. Only the most restrictive features are listed. Other features may limit a specific recreational use.

The degree of soil limitation is expressed as slight, moderate, or severe.

Slight means that soil properties are favorable for the rated use. The limitations are minor and can be easily overcome. Good performance and low maintenance are expected.

Moderate means that soil properties are moderately favorable for the rated use. The limitations can be overcome or modified by special planning, design, or maintenance. During some part of the year, the expected performance may be less desirable than that of soils rated *slight*.

Severe means that soil properties are unfavorable for the rated use. Examples of limitations are slope, bedrock near the surface, flooding, and a seasonal high water table. These limitations generally require major soil reclamation, special design, or intensive maintenance. Overcoming the limitations generally is difficult and costly.

The information in the table "Recreational Development" can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in the table "Building Site Development" and interpretations for septic tank absorption fields in the table "Sanitary Facilities."

Recreational Development

(See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
47:					
Colvin	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
57A:					
Fargo	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
58:					
Kittson	Slight	Slight	Slight	Slight	Slight.
59:					
Grimstad	Slight	Slight	Slight	Slight	Slight.
65:					
Foxhome	Slight	Slight	Slight	Slight	Slight.
66:					
Flaming	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
67A:					
Bearden	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
67B:					
Bearden	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness.
77:					
Garnes	Slight	Slight	Moderate: small stones.	Slight	Slight.
93A:					
Bearden	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
111:					
Hangaard	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty.
116:					
Redby	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: too sandy, wetness.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.
117:					
Cormant	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
145:					
Enstrom	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Moderate: droughty.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
148:					
Poppleton	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
157A:					
Wahpeton	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey, flooding.	Moderate: too clayey.	Severe: too clayey.
157B:					
Wahpeton	Severe: flooding.	Moderate: too clayey.	Moderate: slope, too clayey, flooding.	Moderate: too clayey.	Severe: too clayey.
184A:					
Hamerly	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
187:					
Haug	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
205:					
Karlstad	Slight	Slight	Slight	Slight	Moderate: droughty.
236:					
Vallers	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
242B:					
Marquette	Slight	Slight	Moderate: slope, small stones.	Slight	Severe: droughty.
258B:					
Sandberg	Moderate: too sandy.	Moderate: too sandy.	Severe: small stones.	Slight	Severe: droughty.
280:					
Pelan	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
372:					
Hamar	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
379:					
Percy	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
383:					
Percy	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
384:					
Percy	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
387:					
Roliss	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
412:					
Mavie-----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
418:					
Lamoure---------	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
426:					
Foldahl---------	Slight-----------	Slight-----------	Slight-----------	Slight-----------	Moderate: droughty.
429A:					
Northcote-------	Severe: wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
432:					
Strandquist-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
435:					
Syrene----------	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
439:					
Strathcona------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
481:					
Kratka----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
482:					
Grygla----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
514:					
Tacoosh---------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
540:					
Seelyeville-----	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
541:					
Rifle-----------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
543:					
Markey----------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
544:					
Cathro----------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
546: Lupton----------	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness.	Severe: wetness, excess humus.	Severe: wetness, excess humus.
547: Deerwood--------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
550: Dora------------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
563: Northwood-------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
565: Eckvoll---------	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: small stones.	Moderate: too sandy.	Slight.
582: Roliss----------	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
583: Nereson---------	Slight------------	Slight------------	Moderate: small stones.	Slight------------	Slight.
630: Wildwood--------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
641: Clearwater------	Severe: wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
642: Clearwater------	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
643: Huot------------	Slight------------	Slight------------	Moderate: small stones.	Slight------------	Moderate: droughty.
644: Boash-----------	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
645: Espelie---------	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
647:					
Hilaire	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
648:					
Newfolden	Slight	Slight	Slight	Slight	Slight.
649:					
Reiner	Slight	Slight	Moderate: small stones.	Slight	Slight.
650:					
Reiner	Slight	Slight	Moderate: small stones.	Slight	Slight.
651:					
Thiefriver	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
652:					
Wyandotte	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
653:					
Smiley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
708:					
Rushlake	Moderate: too sandy.	Moderate: too sandy.	Moderate: small stones, too sandy.	Moderate: too sandy.	Severe: droughty.
712:					
Rosewood	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
713:					
Linveldt	Slight	Slight	Moderate: small stones.	Slight	Slight.
721B:					
Corliss	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Severe: droughty.
765:					
Smiley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
794:					
Clearriver	Moderate: too sandy.	Moderate: too sandy.	Moderate: small stones, too sandy.	Moderate: too sandy.	Severe: droughty.
935:					
Hegne	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Fargo	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
936:					
Clearwater	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Reis	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
937:					
Eaglepoint	Severe: wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Northcote	Severe: wetness, too clayey.	Severe: too clayey.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
972:					
Roliss	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Vallers	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1006:					
Fluvaquents	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Haploborolls	Severe: flooding, slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
1030: Pits.					
Udipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.	Severe: slope.
1031:					
Seelyeville	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1143:					
Berner	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Markey	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1144:					
Strathcona	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Kratka	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1146:					
Northwood	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1158:					
Skagen	Slight	Slight	Moderate: small stones.	Slight	Slight.
1170:					
Skagen	Slight	Slight	Moderate: small stones.	Slight	Slight.
1187:					
Dora	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1188:					
Wildwood	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1189:					
Clearwater	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1191:					
Sahkahtay	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1264:					
Ulen	Slight	Slight	Slight	Slight	Moderate: droughty.
1297:					
Augsburg	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
1299:					
Borup	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1304A:					
Glyndon	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
1304B:					
Glyndon	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness.
1315A:					
Wheatville	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
1804:					
Hamre	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1807:					
Cathro----------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1808:					
Markey----------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1871:					
Fargo-----------	Severe: flooding, ponding, too clayey.	Severe: ponding, too clayey.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
1874:					
Radium----------	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Severe: droughty.
1878:					
Hamre-----------	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
1882:					
Rosewood--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Strathcona------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Berner----------	Severe: wetness, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness.	Severe: wetness, excess humus.	Severe: wetness, excess humus.
1963:					
Bearden---------	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
Colvin----------	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
1964:					
Colvin----------	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Fargo-----------	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
1966:					
Rosewood--------	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
Hamar-----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

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Wildlife Habitat

George Davis, area wildlife manager, Minnesota Department of Natural Resources, helped prepare this section.

The conditions of wildlife habitat are related to soil, climate, and land use. Because farming is the major land use in Marshall County, wildlife habitat is mainly limited to the hardwood forested beach ridges and marshes, the scattered hardwood forests in the interbeach area, the marginal and organic soils in the eastern part of the county, scattered woodlots, and rivers. Wildlife habitat typically exists in areas where the soils are less suited to agricultural uses.

The soils of western Marshall County are the most fertile and have been extensively developed for agricultural use. Only minor areas of wildlife habitat remain. These consist of scattered small woodlots and narrow ribbons of habitat along rivers. Wildlife use in these areas is lower than in other areas because of the limited and scattered nature of the habitat. Small numbers of waterfowl and furbearers use the aquatic habitat along the rivers. The hardwood-forested banks of the rivers are used by deer, raccoon, fox, and songbirds. Red fox and Hungarian partridge are common in the open farmland.

Most of the beach ridge and interbeach habitats are in the central part of the county. The diversity of soil types has led to a good mixture of cropland and wildlife habitat. The wildlife habitat is a mixture of mixed hardwood forest, brushland, grass and herbaceous openings, and scattered wetlands. This mixture of habitats supports good populations of deer, moose, grouse, Hungarian partridge, fox, coyote, and raccoon. Waterfowl, furbearers, and sandhill cranes use the wetland areas.

Large blocks of habitat are common in the eastern part of the county. Marginal and organic soils are common in this area, and many have not been developed for agriculture. This part of the county supports large areas of hardwood forests and scattered conifers. Areas of wetlands and brush are also extensive. Large numbers of waterfowl use the developed wetland areas along with deer, moose, black bear, grey wolf, coyote, fox, furbearers, sandhill crane, and grouse.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. If food, cover, or water is missing, inadequate, or inaccessible, wildlife will be scarce or will not inhabit the area.

If the soils have potential for habitat development, wildlife habitat can be created or improved by planting appropriate vegetation, properly managing the existing plant cover, and fostering the natural establishment of desirable plants.

Elements of Wildlife Habitat

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants used by wildlife. Examples are corn, soybeans, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes planted for wildlife food and cover. Examples are bromegrass, timothy, orchardgrass, clover, alfalfa, wheatgrass, and birdsfoot trefoil.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestems, indiangrass, blueberry, goldenrod, lambsquarters, dandelions, blackberry, ragweed, wheatgrass, and nightshade.

The major soil properties affecting the growth of grain and forage crops and wild herbaceous plants are depth of the root zone, texture of the surface layer, the amount of water available to plants, wetness, salinity, and flooding. The length of the growing season also is important.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage that wildlife eat. Examples are oak, poplar, box elder, birch, maple, green ash, willow, and American elm.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Examples of fruit-producing shrubs that are suitable for planting on soils that have good potential for these plants are hawthorn, honeysuckle, American plum, redosier dogwood, chokecherry, serviceberry, silver buffaloberry, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, and ground cover that provide habitat or supply food in the form of browse, seed, or fruit-like cones. Examples are pine, spruce, cedar, and tamarack.

The major soil properties affecting the growth of hardwood and coniferous trees and shrubs are depth of the root zone, the amount of water available to plants, and wetness.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Wetland plants produce food or cover for wetland wildlife. Examples of these plants are smartweeds, wild millet, rushes, sedges, bulrushes, wild rice, arrowhead, waterplantain, cattail, prairie cordgrass, bluejoint grass, asters, and beggarticks.

The major soil properties affecting wetland plants are texture of the surface layer, wetness, acidity or alkalinity, and slope.

Shallow water areas have an average depth of less than 5 feet. They are useful as habitat for some wildlife species. They are naturally wet areas or are created by dams, levees, or water-control measures in marshes or streams. Examples are waterfowl feeding areas, wildlife watering developments, beaver ponds, and other wildlife ponds.

The major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability.

Kinds of Wildlife Habitat

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, and shrubs. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include Hungarian partridge, ring-necked pheasant, sharp-tailed grouse, meadowlark, field sparrow, killdeer, cottontail rabbit, and red fox.

Habitat for woodland wildlife consists of areas of hardwoods or conifers or a mixture of these and associated grasses, legumes, and wild herbaceous plants. The wildlife attracted to this habitat include wild turkey, ruffed grouse, thrushes, woodpeckers, owls, tree squirrels, porcupine, raccoon, white-tailed deer, black bear, and moose.

Habitat for wetland wildlife consists of open, marshy or swampy, shallow water areas, bogs, or flood plains that support water-tolerant plants. The wildlife attracted to this habitat include ducks, geese, herons, bitterns, rails, kingfishers, muskrat, otter, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include pronghorn antelope, mule deer, coyote, sharp-tailed grouse, greater prairie chicken, meadowlark, gopher, and lark bunting.

Wildlife Habitat

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
47: Colvin----------	Good	Good	Fair	Fair	Fair	Fair	Good	Good	Good	Fair	Good	Fair.
57A: Fargo-----------	Good	Good	Fair	---	---	Poor	Poor	Fair	Fair	---	Poor	Poor.
58: Kittson---------	Good	Good	Good	Fair	Fair	Good	Fair	Poor	Good	Fair	Fair	Good.
59: Grimstad--------	Fair	Good	Fair	Fair	Fair	---	Fair	Fair	Fair	Fair	Fair	---
65: Foxhome---------	Good	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor	---
66: Flaming---------	Fair	Fair	Good	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Fair.
67A: Bearden---------	Good	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair	Fair.
67B: Bearden---------	Good	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair	Fair.
77: Garnes----------	Good	Good	Good	Good	Fair	---	Poor	Poor	Good	Good	Poor	---
93A: Bearden---------	Good	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair	Fair.
111: Hangaard--------	Poor	Fair	Fair	Fair	Poor	---	Good	Good	Fair	Fair	Good	---
116: Redby-----------	Poor	Fair	Good	Fair	Good	---	Fair	Fair	Fair	Good	Fair	---
117: Cormant---------	Poor	Fair	Fair	Fair	Fair	---	Good	Good	Fair	Fair	Good	---
145: Enstrom---------	Poor	Fair	Fair	Fair	Fair	---	Poor	Poor	Fair	Good	Poor	---
148: Poppleton-------	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Fair.
157A: Wahpeton--------	Good	Good	Fair	Good	Good	Poor	Poor	Poor	Fair	Good	Poor	Poor.
157B: Wahpeton--------	Good	Good	Fair	Good	Good	Poor	Poor	Very poor.	Fair	Good	Very poor.	Poor.
184A: Hamerly---------	Good	Good	Good	Good	Good	Fair	Fair	Poor	Good	Good	Poor	Fair.
187: Haug------------	Very poor.	Very poor.	Poor	Poor	Poor	---	Good	Good	Very poor.	Poor	Good	---

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
205: Karlstad	Poor	Fair	Fair	Fair	Fair	---	Poor	Very poor.	Poor	Fair	Very poor.	---
236: Vallers	Fair	Fair	Fair	Fair	Poor	Fair	Good	Good	Fair	Fair	Good	Fair.
242B: Marquette	Poor	Poor	Fair	Poor	Poor	---	Very poor.	Very poor.	Poor	Poor	Very poor.	---
258B: Sandberg	Poor	Poor	Good	Poor	Poor	---	Very poor.	Very poor.	Good	Good	Very poor.	---
280: Pelan	Poor	Fair	Fair	Poor	Fair	Fair	Poor	Poor	Fair	Fair	Poor	---
372: Hamar	Poor	Good	Fair	Good	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Fair	Fair.
379: Percy	Good	Good	Fair	Fair	Poor	---	Good	Good	Good	Fair	Fair	---
383: Percy	Good	Good	Fair	Fair	Poor	---	Good	Good	Good	Fair	Fair	---
384: Percy	Fair	Fair	Fair	Fair	Fair	---	Good	Good	Fair	Fair	Good	---
387: Roliss	Fair	Fair	Fair	Fair	Fair	---	Good	Good	Good	Fair	Good	---
412: Mavie	Fair	Fair	Fair	Fair	Poor	Fair	Good	Good	Fair	Fair	Good	Fair.
418: Lamoure	Good	Good	Fair	Good	Good	Fair	Fair	Fair	Good	Good	Fair	Fair.
426: Foldahl	Fair	Good	Good	Fair	Poor	---	Poor	Poor	Fair	Fair	Poor	---
429A: Northcote	Fair	Good	Fair	Fair	Poor	---	Poor	Good	Fair	Poor	Fair	---
432: Strandquist	Fair	Fair	Fair	Fair	Poor	---	Good	Good	Good	Fair	Good	---
435: Syrene	Fair	Fair	Fair	Fair	Poor	Fair	Good	Good	Fair	Fair	Good	Fair.
439: Strathcona	Fair	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	Fair.
481: Kratka	Fair	Good	Good	Fair	Poor	---	Good	Fair	Fair	Fair	Fair	---
482: Grygla	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
514:												
Tacoosh----------	Poor	Poor	Poor	Poor	Poor	---	Good	Good	Poor	Poor	Good	---
540:												
Seelyeville------	Very poor.	Fair	Good	Poor	Poor	---	Good	Good	Fair	Poor	Good	---
541:												
Rifle------------	Fair	Poor	Poor	Poor	Poor	---	Good	Good	Poor	Poor	Good	---
543:												
Markey-----------	Very poor.	Very poor.	Poor	Poor	Poor	---	Good	Good	Poor	Poor	Good	---
544:												
Cathro-----------	Poor	Fair	Fair	Poor	Poor	---	Good	Good	Poor	Poor	Good	---
546:												
Lupton-----------	Fair	Poor	Poor	Poor	Poor	---	Good	Good	Poor	Poor	Good	---
547:												
Deerwood---------	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good	Poor.
550:												
Dora-------------	Very poor.	Very poor.	Very poor.	Poor	Poor	---	Good	Good	Very poor.	Poor	Good	---
563:												
Northwood--------	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good	---
565:												
Eckvoll----------	Poor	Fair	Good	Good	Good	---	Poor	Poor	Fair	Good	Poor	---
582:												
Roliss-----------	Good	Good	Good	Fair	---	---	Good	Fair	Good	Fair	Good	---
583:												
Nereson----------	Good	Good	Good	Good	Poor	---	Poor	Poor	Good	Good	Poor	---
630:												
Wildwood---------	Very poor.	Poor	Poor	Poor	Poor	---	Good	Good	Poor	Poor	Good	---
641:												
Clearwater-------	Good	Good	Fair	Fair	Fair	---	Poor	Good	Good	Fair	Fair	---
642:												
Clearwater-------	Good	Good	Fair	Fair	Fair	---	Poor	Good	Good	Fair	Fair	---
643:												
Huot-------------	Fair	Good	Fair	Fair	Fair	Fair	Poor	Poor	Good	Fair	Fair	Fair.
644:												
Boash------------	Good	Good	Fair	---	---	Poor	Poor	Fair	Fair	---	Fair	---
645:												
Espelie----------	Poor	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	Fair.
647:												
Hilaire----------	Fair	Good	Good	Fair	Fair	---	Poor	Poor	Good	Fair	Poor	---

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
648:												
Newfolden	Good	Good	Good	Good	Fair	---	Poor	Poor	Good	Fair	Poor	---
649:												
Reiner	Good	Good	Good	Good	Good	---	Poor	Poor	Fair	Fair	Poor	Fair.
650:												
Reiner	Good	Good	Good	Good	Good	---	Poor	Poor	Fair	Fair	Poor	Fair.
651:												
Thiefriver	Good	Good	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
652:												
Wyandotte	Poor	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	Fair.
653:												
Smiley	Fair	Fair	Poor	Poor	Poor	Poor	Good	Poor	Poor	Poor	Good	Poor.
708:												
Rushlake	Poor	Good	Good	Good	Good	---	Fair	Poor	Good	Good	Fair	---
712:												
Rosewood	Fair	Fair	Fair	Fair	Fair	---	Good	Good	Fair	Fair	Good	---
713:												
Linveldt	Good	Good	Good	Good	Fair	---	Poor	Poor	Good	Good	Poor	---
721B:												
Corliss	Fair	Fair	Fair	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.	---
765:												
Smiley	Good	Good	Fair	Fair	Fair	Fair	Fair	Good	Fair	---	Fair	Fair.
794:												
Clearriver	Poor	Good	Good	Good	Good	---	Fair	Very poor.	Good	Good	Fair	---
935:												
Hegne	Fair	Fair	Fair	Fair	Poor	Fair	Poor	Good	Fair	Fair	Fair	Fair.
Fargo	Good	Good	Fair	---	---	Poor	Poor	Fair	Fair	---	Poor	Poor.
936:												
Clearwater	Good	Good	Fair	Fair	Fair	---	Poor	Good	Good	Fair	Fair	---
Reis	Fair	Fair	Fair	Poor	Fair	Fair	Good	Good	Fair	Poor	Good	Fair.
937:												
Eaglepoint	Good	Good	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Poor.
Northcote	Fair	Good	Fair	Fair	Poor	---	Poor	Good	Fair	Poor	Fair	---
972:												
Roliss	Good	Good	Good	Fair	---	---	Good	Fair	Good	Fair	Fair	---
Vallers	Fair	Fair	Fair	Fair	Poor	Fair	Good	Good	Fair	Fair	Good	Fair.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1006:												
Fluvaquents-----	Poor	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	Poor.
Haploborolls----	Poor	Fair	Good	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
1030:												
Pits.												
Udipsamments.												
1031:												
Seelyeville-----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
1143:												
Berner----------	Very poor.	Fair	Fair	Poor	Poor	---	Good	Good	Fair	Poor	Good	Fair.
Markey----------	Very poor.	Very poor.	Poor	Poor	Poor	---	Good	Good	Poor	Poor	Good	---
1144:												
Strathcona------	Fair	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	Poor.
Kratka----------	Poor	Poor	Poor	Poor	Poor	---	Good	Good	Poor	Poor	Good	---
1146:												
Northwood-------	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good	---
1158:												
Skagen----------	Good	Good	Good	Good	Good	Fair	Fair	Poor	Good	Good	Poor	Fair.
1170:												
Skagen----------	Good	Good	Good	Good	Good	Fair	Fair	Poor	Good	Good	Poor	Fair.
1187:												
Dora------------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
1188:												
Wildwood--------	Very poor.	Very poor.	Poor	Poor	Very poor.	---	Good	Good	Very poor.	Poor	Good	---
1189:												
Clearwater------	Poor	Poor	Poor	Poor	---	Good	Good	Good	Poor	Poor	Good	Poor.
1191:												
Sahkahtay-------	Fair	Fair	Poor	Fair	Fair	---	Fair	Good	Fair	Fair	Fair	Good.
1264:												
Ulen------------	Fair	Good	Good	Fair	Poor	---	Poor	Poor	Fair	Fair	Poor	---
1297:												
Augsburg--------	Good	Good	Fair	Fair	Poor	Fair	Fair	Fair	Good	Fair	Fair	Fair.
1299:												
Borup-----------	Fair	Fair	Fair	Fair	Poor	Fair	Good	Good	Fair	Fair	Good	Fair.
1304A:												
Glyndon---------	Good	Good	Good	Fair	Poor	Fair	Poor	Poor	Good	Fair	Poor	Fair.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1304B:												
Glyndon----------	Good	Good	Good	Fair	Poor	Fair	Poor	Poor	Good	Fair	Poor	Fair.
1315A:												
Wheatville-------	Good	Good	Good	Fair	Poor	Fair	Poor	Fair	Good	Fair	Fair	Fair.
1804:												
Hamre------------	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good	Poor.
1807:												
Cathro-----------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
1808:												
Markey-----------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
1871:												
Fargo------------	Very poor.	Poor	Fair	---	---	Poor	Poor	Good	Poor	---	Fair	Poor.
1874:												
Radium-----------	Poor	Poor	Fair	Poor	---	Fair	Poor	Very poor.	Poor	Poor	Very poor.	Fair.
1878:												
Hamre------------	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good	Poor.
1882:												
Rosewood---------	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Fair	Poor.
Strathcona-------	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Fair	Poor.
Berner-----------	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Fair	Poor.
1963:												
Bearden----------	Good	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair	Fair.
Colvin-----------	Good	Good	Fair	Fair	Fair	Fair	Good	Good	Good	Fair	Good	Fair.
1964:												
Colvin-----------	Good	Good	Fair	Fair	Fair	Fair	Good	Good	Good	Fair	Good	Fair.
Fargo------------	Good	Good	Fair	---	---	Poor	Poor	Fair	Fair	---	Poor	Poor.
1966:												
Rosewood---------	Fair	Fair	Fair	Fair	Fair	---	Good	Good	Fair	Fair	Good	---
Hamar------------	Poor	Good	Fair	Good	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Fair	Fair.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

The table "Building Site Development" shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, potential for frost action, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

The table "Sanitary Facilities" shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. It also shows the suitability of the soils for use as a daily cover for landfill.

Soil properties are important in selecting sites for sanitary facilities and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Soil limitation ratings of *slight, moderate,* or *severe* are given for septic tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings of *good, fair,* and *poor* are given for daily cover for landfill.

A rating of *slight* or *good* indicates that the soils have no limitations or that the limitations can be easily overcome. Good performance and low maintenance can be expected. A rating of *moderate* or *fair* indicates that the limitations should be recognized but generally can be overcome by good management or special design. A rating of *severe* or *poor* indicates that overcoming the limitations is difficult or impractical. Increased maintenance may be required.

Septic tank absorption fields are areas in which subsurface systems of tile or perforated pipe distribute effluent from a septic tank into the natural soil. The centerline of the tile is assumed to be at a depth of 24 inches. Only the part of the soil between depths of 24 and 60 inches is considered in making the ratings. The soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction and maintenance of the system, and those that may affect public health.

The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted, relatively impervious soil material. Aerobic lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Relatively impervious soil material for the lagoon floor and sides is desirable to minimize seepage and contamination of local ground water.

The table "Sanitary Facilities" gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Trench sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. Soil properties that influence the risk of pollution, the ease of excavation, trafficability, and revegetation are the major considerations in rating the soils.

Area sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil that is imported from a source away from the site. A final cover of soil at least 2 feet thick is placed over the completed landfill. Soil properties that influence trafficability, revegetation, and the risk of pollution are the main considerations in rating the soils for area sanitary landfills.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. The ratings in the table "Sanitary Facilities" are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The suitability of a soil for use as cover is based on properties that affect workability and the ease of digging, moving, and spreading the material over the refuse daily during both wet and dry periods.

Soil texture, wetness, rock fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Waste Management

Soil properties are important when organic waste is applied as fertilizer and wastewater is applied in irrigated areas. They also are important when the soil is used as a medium for the treatment and disposal of the organic waste and wastewater. Unfavorable soil properties can result in environmental damage.

The use of organic waste and wastewater as production resources results in energy and resource conservation and minimizes the problems associated with waste disposal. If disposal is the goal, applying a maximum amount of the organic waste or the wastewater to a minimal area holds costs to a minimum and environmental damage is the main hazard. If reuse is the goal, a minimum amount should be applied to a maximum area and environmental damage is unlikely.

Interpretations developed for waste management may include ratings for manure- and food-processing waste, municipal sewage sludge, use of wastewater for irrigation, and treatment of wastewater by slow rate, overland flow, and rapid infiltration processes.

Specific information regarding waste management is available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Construction Materials

The table "Construction Materials" gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In the table "Construction Materials," the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel, or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have one or more of the following characteristics: a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the table "Construction Materials," only the probability of finding material in suitable quantity in or below the soil is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

The table "Water Management" gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In the table "Water Management," the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff.

Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances (such as salts), and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Building Site Development

(See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
47:						
Colvin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
57A:						
Fargo	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
58:						
Kittson	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: frost action.	Slight.
59:						
Grimstad	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Slight.
65:						
Foxhome	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Slight.
66:						
Flaming	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Moderate: droughty.
67A:						
Bearden	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: wetness.
67B:						
Bearden	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: wetness.
77:						
Garnes	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Slight.
93A:						
Bearden	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: wetness.
111:						
Hangaard	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, droughty.
116:						
Redby	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
117: Cormant	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
145: Enstrom	Severe: cutbanks cave.	Slight	Moderate: wetness, shrink-swell.	Slight	Moderate: frost action.	Moderate: droughty.
148: Poppleton	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Moderate: droughty.
157A: Wahpeton	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: too clayey.
157B: Wahpeton	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: too clayey.
184A: Hamerly	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
187: Haug	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
205: Karlstad	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Moderate: droughty.
236: Vallers	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
242B: Marquette	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
258B: Sandberg	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
280: Pelan	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Moderate: droughty.
372: Hamar	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
379:						
Percy	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
383:						
Percy	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
384:						
Percy	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
387:						
Roliss	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
412:						
Mavie	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
418:						
Lamoure	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
426:						
Foldahl	Severe: cutbanks cave.	Slight	Moderate: wetness, shrink-swell.	Slight	Severe: frost action.	Moderate: droughty.
429A:						
Northcote	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Severe: too clayey.
432:						
Strandquist	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
435:						
Syrene	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
439:						
Strathcona	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
481:						
Kratka	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
482:						
Grygla	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
514:						
Tacoosh	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
540:						
Seelyeville	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
541:						
Rifle	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, excess humus.
543:						
Markey	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
544:						
Cathro	Severe: excess humus, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
546:						
Lupton	Severe: excess humus, wetness.	Severe: subsides, wetness, low strength.	Severe: subsides, wetness, low strength.	Severe: subsides, wetness, low strength.	Severe: subsides, wetness, frost action.	Severe: wetness, excess humus.
547:						
Deerwood	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, excess humus.
550:						
Dora	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, shrink-swell.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
563:						
Northwood	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
565:						
Eckvoll	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
582:						
Roliss	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
583:						
Nereson	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Slight.
630:						
Wildwood	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, excess humus.
641:						
Clearwater	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Severe: too clayey.
642:						
Clearwater	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
643:						
Huot	Severe: cutbanks cave.	Slight	Severe: shrink-swell.	Slight	Severe: frost action.	Moderate: droughty.
644:						
Boash	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
645:						
Espelie	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness, droughty.
647:						
Hilaire	Severe: cutbanks cave.	Slight	Severe: shrink-swell.	Slight	Severe: frost action.	Moderate: droughty.
648:						
Newfolden	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Slight.
649:						
Reiner	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Slight.
650:						
Reiner	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Slight.
651:						
Thiefriver	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
652:						
Wyandotte	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
653:						
Smiley	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
708:						
Rushlake	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.
712:						
Rosewood	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
713:						
Linveldt	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Severe: frost action.	Slight.
721B:						
Corliss	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
765:						
Smiley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
794:						
Clearriver	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Severe: droughty.
935:						
Hegne	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
Fargo	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
936:						
Clearwater	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
Reis	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
937:						
Eaglepoint------	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
Northcote-------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, frost action.	Severe: too clayey.
972:						
Roliss----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Vallers---------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
1006:						
Fluvaquents-----	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness, flooding.
Haploborolls----	Severe: slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: flooding, slope.	Severe: slope.	Severe: slope.
1030:						
Pits.						
Udipsamments----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
1031:						
Seelyeville-----	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
1143:						
Berner----------	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
Markey----------	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
1144:						
Strathcona------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Kratka----------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1146: Northwood-------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
1158: Skagen----------	Moderate: wetness.	Slight---------	Moderate: wetness.	Slight---------	Severe: frost action.	Slight.
1170: Skagen----------	Moderate: wetness.	Slight---------	Moderate: wetness.	Slight---------	Severe: frost action.	Slight.
1187: Dora------------	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, shrink-swell.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
1188: Wildwood--------	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, excess humus.
1189: Clearwater------	Severe: cutbanks cave, ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
1191: Sahkahtay-------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1264: Ulen------------	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Moderate: droughty.
1297: Augsburg--------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
1299: Borup-----------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
1304A: Glyndon---------	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Moderate: wetness.
1304B: Glyndon---------	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: frost action.	Moderate: wetness.
1315A: Wheatville------	Severe: cutbanks cave.	Slight---------	Severe: shrink-swell.	Slight---------	Severe: frost action.	Slight.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1804: Hamre	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
1807: Cathro	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
1808: Markey	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
1871: Fargo	Severe: cutbanks cave, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
1874: Radium	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Severe: droughty.
1878: Hamre	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
1882: Rosewood	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Strathcona	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Berner	Severe: cutbanks cave, wetness.	Severe: subsides, wetness.	Severe: subsides, wetness.	Severe: subsides, wetness.	Severe: subsides, wetness, frost action.	Severe: wetness, excess humus.
1963: Bearden	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Moderate: wetness.
Colvin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
1964: Colvin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Fargo	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1966:						
Rosewood--------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Hamar-----------	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

Sanitary Facilities

(Some restrictive soil features are defined in the Glossary. See text for definitions of "slight," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
47: Colvin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
57A: Fargo	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
58: Kittson	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
59: Grimstad	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: wetness.
65: Foxhome	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
66: Flaming	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
67A: Bearden	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: hard to pack.
67B: Bearden	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: hard to pack.
77: Garnes	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: small stones, wetness.
93A: Bearden	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: hard to pack.
111: Hangaard	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
116:					
Redby	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
117:					
Cormant	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
145:					
Enstrom	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.
148:					
Poppleton	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
157A:					
Wahpeton	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
157B:					
Wahpeton	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
184A:					
Hamerly	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
187:					
Haug	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
205:					
Karlstad	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
236:					
Vallers	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
242B:					
Marquette	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
258B:					
Sandberg	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
280:					
Pelan	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: wetness.
372:					
Hamar	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
379:					
Percy	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
383:					
Percy	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
384:					
Percy	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
387:					
Roliss	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
412:					
Mavie	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
418:					
Lamoure	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
426:					
Foldahl	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, small stones, wetness.
429A:					
Northcote	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
432:					
Strandquist	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
435:					
Syrene----------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
439:					
Strathcona------	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
481:					
Kratka----------	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
482:					
Grygla----------	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
514:					
Tacoosh---------	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
540:					
Seelyeville-----	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
541:					
Rifle-----------	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
543:					
Markey----------	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
544:					
Cathro----------	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
546:					
Lupton----------	Severe: subsides, wetness, percs slowly.	Severe: seepage, excess humus, wetness.	Severe: seepage, wetness, excess humus.	Severe: seepage, wetness.	Poor: wetness, excess humus.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
547:					
Deerwood	Severe: ponding, poor filter.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
550:					
Dora	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, too clayey.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, ponding.
563:					
Northwood	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
565:					
Eckvoll	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Severe: seepage.	Fair: too clayey, wetness.
582:					
Roliss	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
583:					
Nereson	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: small stones, wetness.
630:					
Wildwood	Severe: ponding, percs slowly.	Severe: excess humus, ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
641:					
Clearwater	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
642:					
Clearwater	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
643:					
Huot	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack.
644:					
Boash	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Poor: wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
645:					
Espelie	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
647:					
Hilaire	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack.
648:					
Newfolden	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
649:					
Reiner	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, small stones, wetness.
650:					
Reiner	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, small stones, wetness.
651:					
Thiefriver	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
652:					
Wyandotte	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
653:					
Smiley	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
708:					
Rushlake	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
712:					
Rosewood	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
713:					
Linveldt	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Fair: too clayey, wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
721B:					
Corliss	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
765:					
Smiley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
794:					
Clearriver	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
935:					
Hegne	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Fargo	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
936:					
Clearwater	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Reis	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
937:					
Eaglepoint	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Northcote	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
972:					
Roliss	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Vallers	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
1006:					
Fluvaquents	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1006:					
Haploborolls----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
1030:					
Pits.					
Udipsamments----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
1031:					
Seelyeville-----	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
1143:					
Berner----------	Severe: ponding, percs slowly, poor filter.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Markey----------	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
1144:					
Strathcona------	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
Kratka----------	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
1146:					
Northwood-------	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
1158:					
Skagen----------	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness.
1170:					
Skagen----------	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness.
1187:					
Dora------------	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, too clayey.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, ponding.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1188: Wildwood--------	Severe: ponding, percs slowly.	Severe: excess humus, ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
1189: Clearwater------	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
1191: Sahkahtay-------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
1264: Ulen------------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
1297: Augsburg--------	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack, wetness.
1299: Borup-----------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: wetness.
1304A: Glyndon---------	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Fair: too sandy, wetness.
1304B: Glyndon---------	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Fair: too sandy, wetness.
1315A: Wheatville------	Severe: wetness, percs slowly.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack.
1804: Hamre-----------	Severe: ponding, percs slowly.	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
1807: Cathro----------	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1808:					
Markey	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
1871:					
Fargo	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
1874:					
Radium	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
1878:					
Hamre	Severe: ponding, percs slowly.	Severe: excess humus, ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
1882:					
Rosewood	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Strathcona	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
Berner	Severe: wetness, percs slowly, poor filter.	Severe: seepage, excess humus, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
1963:					
Bearden	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: hard to pack.
Colvin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
1964:					
Colvin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Fargo	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
1966:					
Rosewood	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1966:					
Hamar-----------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

Construction Materials

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
47:				
Colvin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
57A:				
Fargo	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
58:				
Kittson	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
59:				
Grimstad	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
65:				
Foxhome	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
66:				
Flaming	Good	Probable	Improbable: too sandy.	Poor: too sandy.
67A:				
Bearden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
67B:				
Bearden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
77:				
Garnes	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
93A:				
Bearden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
111:				
Hangaard	Poor: wetness.	Probable	Probable	Poor: too sandy, small stones, wetness.
116:				
Redby	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
117:				
Cormant	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
145:				
Enstrom	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
148:				
Poppleton	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
157A:				
Wahpeton	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
157B:				
Wahpeton	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
184A:				
Hamerly	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
187:				
Haug	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
205:				
Karlstad	Fair: wetness.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
236:				
Vallers	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
242B:				
Marquette	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
258B:				
Sandberg	Good	Probable	Probable	Poor: small stones, area reclaim.
280:				
Pelan	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
372:				
Hamar	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
379:				
Percy	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
383:				
Percy	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
384:				
Percy	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
387:				
Roliss	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
412:				
Mavie	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones, wetness.
418:				
Lamoure	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
426:				
Foldahl	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
429A:				
Northcote	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
432:				
Strandquist	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
435:				
Syrene	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
439:				
Strathcona	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
481:				
Kratka	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
482:				
Grygla	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
514:				
Tacoosh	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
540:				
Seelyeville	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
541:				
Rifle	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
543:				
Markey	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
544:				
Cathro	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
546:				
Lupton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
547:				
Deerwood	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, wetness.
550:				
Dora	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
563:				
Northwood	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
565:				
Eckvoll	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
582:				
Roliss	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
583:				
Nereson	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
630:				
Wildwood	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
641:				
Clearwater	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
642:				
Clearwater	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
643:				
Huot	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
644:				
Boash	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
645:				
Espelie	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
647:				
Hilaire	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
648:				
Newfolden	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
649:				
Reiner	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
650:				
Reiner	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
651:				
Thiefriver	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
652:				
Wyandotte	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
653:				
Smiley	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
708:				
Rushlake	Fair: wetness.	Probable	Probable	Poor: too sandy, small stones, area reclaim.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
712:				
Rosewood	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
713:				
Linveldt	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
721B:				
Corliss	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
765:				
Smiley	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
794:				
Clearriver	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
935:				
Hegne	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Fargo	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
936:				
Clearwater	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Reis	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
937:				
Eaglepoint	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Northcote	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
972:				
Roliss	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Vallers	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1006:				
Fluvaquents	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Haploborolls	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
1030:				
Pits.				
Udipsamments	Poor: slope.	Probable	Probable	Poor: too sandy, slope.
1031:				
Seelyeville	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
1143:				
Berner	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Markey	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
1144:				
Strathcona	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
Kratka	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
1146:				
Northwood	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
1158:				
Skagen	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
1170:				
Skagen	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
1187:				
Dora	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
1188:				
Wildwood	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1189:				
Clearwater	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
1191:				
Sahkahtay	Poor: wetness.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
1264:				
Ulen	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
1297:				
Augsburg	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, thin layer.
1299:				
Borup	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1304A:				
Glyndon	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
1304B:				
Glyndon	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
1315A:				
Wheatville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, thin layer.
1804:				
Hamre	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1807:				
Cathro	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
1808:				
Markey	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
1871:				
Fargo	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
1874:				
Radium	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, small stones.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1878:				
Hamre	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1882:				
Rosewood	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Strathcona	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
Berner	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
1963:				
Bearden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Colvin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
1964:				
Colvin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Fargo	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
1966:				
Rosewood	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Hamar	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.

Water Management

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
47: Colvin	Slight	Severe: wetness.	Severe: slow refill.	Frost action	Wetness	Wetness	Wetness.
57A: Fargo	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
58: Kittson	Moderate: seepage.	Moderate: piping, wetness.	Severe: slow refill.	Frost action	Wetness	Wetness	Favorable.
59: Grimstad	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Favorable	Wetness	Erodes easily, wetness, soil blowing.	Erodes easily.
65: Foxhome	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Frost action	Wetness, soil blowing.	Wetness, soil blowing.	Favorable.
66: Flaming	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
67A: Bearden	Slight	Severe: wetness.	Severe: slow refill.	Frost action	Wetness	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth.
67B: Bearden	Moderate: slope.	Severe: wetness.	Severe: slow refill.	Frost action, slope.	Slope, wetness.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth.
77: Garnes	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Frost action	Wetness, soil blowing.	Wetness, soil blowing.	Rooting depth.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
93A:							
Bearden----------	Slight----------	Severe: wetness.	Severe: slow refill.	Frost action---	Wetness---------	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth.
111:							
Hangaard---------	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, soil blowing.	Wetness, too sandy, soil blowing.	Wetness, droughty.
116:							
Redby------------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
117:							
Cormant----------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
145:							
Enstrom----------	Severe: seepage.	Severe: piping.	Severe: slow refill, cutbanks cave.	Favorable------	Wetness, droughty.	Erodes easily, wetness.	Erodes easily, droughty.
148:							
Poppleton--------	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
157A:							
Wahpeton---------	Moderate: seepage.	Severe: hard to pack.	Severe: no water.	Deep to water	Slow intake, flooding.	Favorable------	Favorable.
157B:							
Wahpeton---------	Moderate: seepage, slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, slow intake, flooding.	Favorable------	Favorable.
184A:							
Hamerly----------	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Frost action---	Wetness---------	Erodes easily, wetness.	Erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
187: Haug	Moderate: seepage.	Severe: piping, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
205: Karlstad	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Large stones, wetness, too sandy.	Large stones, droughty.
236: Vallers	Slight	Severe: piping, wetness.	Severe: slow refill.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.
242B: Marquette	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
258B: Sandberg	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty.
280: Pelan	Severe: seepage.	Severe: piping.	Moderate: deep to water, slow refill, cutbanks cave.	Favorable	Wetness, droughty.	Wetness, soil blowing.	Droughty, rooting depth.
372: Hamar	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
379: Percy	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness	Wetness.
383: Percy	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness	Wetness.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
384: Percy-----------	Moderate: seepage.	Severe: piping, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
387: Roliss----------	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
412: Mavie-----------	Severe: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action---	Wetness, droughty, soil blowing.	Erodes easily, wetness, soil blowing.	Wetness, Erodes easily, droughty.
418: Lamoure---------	Moderate: seepage.	Severe: hard to pack, wetness.	Severe: slow refill.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
426: Foldahl---------	Severe: seepage.	Severe: piping.	Severe: slow refill, cutbanks cave.	Frost action---	Wetness, droughty.	Erodes easily, wetness, soil blowing.	Erodes easily, droughty.
429A: Northcote-------	Slight---------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, slow intake.	Wetness, percs slowly.	Wetness, percs slowly.
432: Strandquist-----	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action---	Wetness--------	Erodes easily, wetness.	Wetness, erodes easily.
435: Syrene----------	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, soil blowing.	Erodes easily, wetness, too sandy.	Wetness, erodes easily, droughty.
439: Strathcona------	Severe: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
481:							
Kratka----------	Severe: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Favorable------	Wetness, droughty.	Wetness, soil blowing.	Wetness, droughty, rooting depth.
482:							
Grygla----------	Severe: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action---	Wetness, soil blowing.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily.
514:							
Tacoosh---------	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
540:							
Seelyeville-----	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
541:							
Rifle-----------	Severe: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
543:							
Markey----------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
544:							
Cathro----------	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
546:							
Lupton----------	Severe: seepage.	Severe: excess humus, wetness.	Severe: slow refill.	Subsides, frost action.	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
547:							
Deerwood--------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, subsides, cutbanks cave.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
550: Dora	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly, subsides.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
563: Northwood	Severe: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing, rooting depth.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily, rooting depth.
565: Eckvoll	Severe: seepage.	Moderate: piping, wetness.	Severe: no water.	Frost action	Wetness, fast intake, soil blowing.	Erodes easily, wetness, soil blowing.	Erodes easily.
582: Roliss	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Frost action	Wetness	Wetness	Wetness.
583: Nereson	Severe: seepage.	Severe: seepage, piping.	Moderate: deep to water, slow refill.	Frost action	Wetness, soil blowing.	Wetness, soil blowing.	Favorable.
630: Wildwood	Slight	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
641: Clearwater	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
642: Clearwater	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
643: Huot	Severe: seepage.	Severe: hard to pack.	Severe: slow refill, cutbanks cave.	Percs slowly, frost action.	Wetness, droughty.	Wetness, soil blowing, percs slowly.	Droughty, percs slowly.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
644: Boash	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness	Wetness, percs slowly.
645: Espelie	Severe: seepage.	Severe: wetness.	Severe: slow refill, cutbanks cave.	Percs slowly, frost action.	Wetness, droughty, soil blowing.	Wetness, soil blowing, percs slowly.	Wetness, droughty, percs slowly.
647: Hilaire	Severe: seepage.	Severe: hard to pack.	Severe: slow refill, cutbanks cave.	Percs slowly, frost action.	Wetness, droughty, fast intake.	Wetness, soil blowing, percs slowly.	Droughty, percs slowly.
648: Newfolden	Moderate: seepage.	Severe: piping.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness	Percs slowly.
649: Reiner	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Frost action	Wetness, fast intake, soil blowing.	Wetness, soil blowing.	Rooting depth.
650: Reiner	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Frost action	Wetness, soil blowing.	Wetness, soil blowing.	Rooting depth.
651: Thiefriver	Severe: seepage.	Severe: wetness.	Severe: slow refill, cutbanks cave.	Percs slowly, frost action.	Wetness, droughty, soil blowing.	Wetness, soil blowing, percs slowly.	Wetness, droughty, percs slowly.
652: Wyandotte	Severe: seepage.	Severe: hard to pack, wetness.	Severe: slow refill, cutbanks cave.	Percs slowly, frost action.	Wetness, droughty, percs slowly.	Wetness, percs slowly.	Wetness, droughty, percs slowly.
653: Smiley	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
708: Rushlake	Severe: seepage.	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
712: Rosewood	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
713: Linveldt	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Frost action	Wetness	Wetness, soil blowing.	Favorable.
721B: Corliss	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
765: Smiley	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness	Wetness.
794: Clearriver	Severe: seepage.	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
935: Hegne	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Fargo	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
936: Clearwater	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Reis	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
937: Eaglepoint	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
937:							
Northcote	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, slow intake.	Wetness, percs slowly.	Wetness, percs slowly.
972:							
Roliss	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Frost action	Wetness	Wetness	Wetness.
Vallers	Slight	Severe: piping, wetness.	Severe: slow refill.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.
1006:							
Fluvaquents	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Wetness.
Haploborolls	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope	Slope.
1030:							
Pits.							
Udipsamments	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
1031:							
Seelyeville	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
1143:							
Berner	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing, rooting depth.	Ponding, soil blowing.	Wetness, rooting depth.
Markey	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
1144:							
Strathcona	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1144: Kratka	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding	Ponding, soil blowing.	Ponding, soil blowing.	Wetness, rooting depth.
1146: Northwood	Severe: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing, rooting depth.	Ponding, soil blowing.	Wetness, rooting depth.
1158: Skagen	Severe: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Frost action	Wetness	Wetness	Favorable.
1170: Skagen	Severe: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Frost action	Wetness	Wetness	Favorable.
1187: Dora	Severe: seepage.	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
1188: Wildwood	Slight	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, soil blowing, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
1189: Clearwater	Slight	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
1191: Sahkahtay	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
1264: Ulen	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Droughty.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1297:							
Augsburg---------	Severe: seepage.	Severe: hard to pack, wetness.	Severe: slow refill, cutbanks cave.	Percs slowly, frost action.	Wetness, soil blowing, percs slowly.	Wetness, soil blowing, percs slowly.	Wetness, percs slowly.
1299:							
Borup------------	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
1304A:							
Glyndon----------	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, soil blowing.	Erodes easily, wetness, soil blowing.	Erodes easily.
1304B:							
Glyndon----------	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, slope, cutbanks cave.	Slope, wetness, soil blowing.	Erodes easily, wetness, soil blowing.	Erodes easily.
1315A:							
Wheatville-------	Severe: seepage.	Severe: hard to pack.	Severe: slow refill, cutbanks cave.	Percs slowly, frost action.	Wetness, soil blowing.	Wetness, soil blowing, percs slowly.	Percs slowly.
1804:							
Hamre------------	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
1807:							
Cathro-----------	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding---------	Ponding---------	Wetness.
1808:							
Markey-----------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
1871:							
Fargo------------	Slight----------	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1874:							
Radium----------	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
1878:							
Hamre-----------	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
1882:							
Rosewood--------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Strathcona------	Severe: seepage.	Severe: piping, wetness.	Severe: slow refill, cutbanks cave.	Frost action---	Wetness, droughty, soil blowing.	Wetness, soil blowing.	Wetness, droughty.
Berner----------	Severe: seepage.	Severe: wetness.	Severe: slow refill, cutbanks cave.	Subsides, frost action.	Wetness, soil blowing, rooting depth.	Wetness, soil blowing.	Wetness, rooting depth.
1963:							
Bearden---------	Slight---------	Severe: wetness.	Severe: slow refill.	Frost action---	Wetness--------	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth.
Colvin----------	Slight---------	Severe: wetness.	Severe: slow refill.	Frost action---	Wetness--------	Wetness--------	Wetness.
1964:							
Colvin----------	Slight---------	Severe: wetness.	Severe: slow refill.	Frost action---	Wetness--------	Wetness--------	Wetness.
Fargo-----------	Slight---------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
1966:							
Rosewood--------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1966:							
Hamar-----------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.

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Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

The table "Engineering Index Properties" gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions in Part I of this survey.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

The tables "Physical Properties of the Soils" and "Chemical Properties of the Soils" show estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions in Part I of this survey.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In the table "Physical Properties of the Soils," the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent;

moderate, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the table "Physical Properties of the Soils," the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils generally are not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams that have more than 5 percent finely divided calcium carbonate. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils have less than 5 percent finely divided calcium carbonate. They are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

In the table "Chemical Properties of the Soils," *cation-exchange capacity* is the total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. It is a measurement of the nutrient-holding capacity of the soil.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate is expressed as a weighted percentage of the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients, such as phosphorus, is affected by the amount of carbonates in the soil.

Gypsum is expressed as the percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Soils high in gypsum, such as those that are more than 10 percent gypsum, may collapse if the gypsum is removed by percolating water. Gypsum is corrosive to concrete. Corrosion of concrete is most likely to occur in soils that are more than about 1 percent gypsum when wetting and drying occur.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of the soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ration (SAR) is a measure of the amount of sodium relative to calcium and magnesium in the water extract from saturated soil paste. Soils that have SAR values of 13 or more may have an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Water Features

The table "Water Features" gives estimates of several important water features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Hydrologic soil groups are groups of soils that, when saturated, have the same runoff potential under similar storm and ground cover conditions. The soil properties that affect the runoff potential are those that influence the minimum rate of infiltration in a bare soil after prolonged wetting and when the soil is not frozen. These properties include the depth to a seasonal high water table, the intake rate, permeability after prolonged wetting, and the depth to a very slowly permeable layer. The influences of ground cover and slope are treated independently and are not taken into account in hydrologic soil groups.

In the definitions of the hydrologic soil groups, the infiltration rate is the rate at which water enters the soil at the surface and is controlled by surface conditions. The transmission rate is the rate at which water moves through the soil and is controlled by properties of the soil layers.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of very deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have a moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils that have a moderately fine or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clayey soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams or by runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in marshes and swamps or in closed depressions is considered to be ponding.

The table gives the frequency and duration of flooding and the time of year when flooding is most likely to occur. Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as none, rare, occasional, or frequent. *None* means flooding is not probable; *rare* that it is unlikely but is possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is 50 percent in any year).

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 to 30 days), and *very long* (more than 30 days). The time of year that flooding is most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is a zone of saturation at the highest average depth during the wettest season. It is at least 6 inches thick, persists in the soil for more than a few weeks, and is within 6 feet of the surface. Indicated in the table are the depth to the seasonal high water table, the kind of water table, and the months of the year when the water table usually is highest.

An *apparent* water table is indicated by the level at which water stands in a freshly dug, unlined borehole after adequate time for adjustments in the surrounding soil.

A *perched* water table is one that is above an unsaturated zone in the soil. The basis for determining that a water table is perched may be general knowledge of the area. The water table is proven to be perched if the water level in a borehole is observed to fall when the borehole is extended.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The maximum depth refers to the depth of the water above the surface of the soil.

Soil Features

The table "Soil Features" gives estimates of several important soil features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Depth to bedrock is given if bedrock is within a depth of 60 inches. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. The table shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

A *low* potential for frost action indicates that the soil is rarely susceptible to the formation of ice lenses; a *moderate* potential indicates that the soil is susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength; and a *high* potential indicates that the soil is highly susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate content, texture, moisture content, and acidity of the soil.

Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Properties

(Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
47:												
Colvin----------	0-9	Silty clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-95	35-50	15-30
	9-29	Silt loam, silty clay loam.	CL	A-6, A-7	0	0	100	100	90-100	80-95	25-50	10-30
	29-60	Loam, silt loam, silty clay loam.	CL	A-6, A-7	0	0	100	100	90-100	70-95	25-50	10-25
57A:												
Fargo-----------	0-11	Silty clay-----	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50
	11-17	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50
	17-60	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50
58:												
Kittson---------	0-11	Loam-----------	CL, CL-ML	A-6, A-4	0	0	100	95-100	85-95	50-75	20-40	5-20
	11-15	Loam, fine sandy loam, sandy loam.	CL, SC	A-6	0	0-5	90-100	65-100	60-90	40-75	20-40	10-20
	15-60	Loam, clay loam	CL	A-6	0	0-2	95-100	85-98	80-90	50-75	20-40	10-20
59:												
Grimstad--------	0-10	Fine sandy loam	SM, SC-SM	A-4, A-2	0	0	100	100	80-100	15-50	15-30	NP-7
	10-29	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM	A-2, A-3	0	0	100	95-100	80-90	5-35	0-25	NP-4
	29-60	Sandy loam, fine sandy loam, loam.	SC, CL, SC-SM, CL-ML	A-4, A-6	0	0-3	95-100	85-100	70-90	40-85	15-40	5-20
65:												
Foxhome---------	0-8	Sandy loam-----	SM	A-4	0	0-2	95-100	90-100	75-90	35-50	15-30	NP-5
	8-14	Loamy sand, sandy loam, gravelly loam.	SM, SP-SM	A-2, A-4	0	0-2	95-100	70-100	45-80	10-50	20-30	NP-5
	14-26	Very gravelly sand, very gravelly coarse sand, very gravelly loamy sand.	SP, GP, SP-SM, GP-GM	A-1	0	2-5	50-75	40-60	20-50	0-10	---	NP
	26-60	Loam, clay loam, silt loam.	ML, CL, CL-ML	A-4, A-6	0	1-5	90-100	85-100	75-90	50-80	20-40	1-15
66:												
Flaming---------	0-15	Loamy fine sand	SM, SP-SM	A-2, A-3	0	0	100	100	75-90	5-30	0-14	NP
	15-60	Fine sand, loamy sand, sand.	SM, SP-SM	A-2, A-3	0	0	100	100	75-90	5-30	0-14	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
67A:												
Bearden----------	0-9	Silt loam------	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	70-90	20-40	5-20
	9-16	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	0	100	100	90-100	70-95	25-55	10-30
	16-60	Silt loam, silty clay loam, loam.	CL, CH	A-6, A-7	0	0	100	100	90-100	70-95	25-55	10-30
67B:												
Bearden----------	0-8	Silt loam------	CL-ML, CL	A-4, A-6	0	0	100	100	90-100	70-90	20-40	5-20
	8-14	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	0	100	100	90-100	70-95	25-55	10-30
	14-60	Silt loam, silty clay loam, loam.	CL, CH	A-6, A-7	0	0	100	100	90-100	70-95	25-55	10-30
77:												
Garnes-----------	0-10	Fine sandy loam	SM	A-4	0	0-3	95-100	85-100	55-75	35-50	20-30	NP-5
	10-17	Clay loam, sandy clay loam, loam.	CL, SC	A-6, A-4	0	2-5	95-100	80-100	70-100	45-80	20-40	7-20
	17-60	Sandy loam, loam, fine sandy loam.	SM, ML, CL, SC	A-4, A-6	0	1-5	95-100	75-95	60-90	35-65	15-40	1-15
93A:												
Bearden----------	0-11	Silty clay loam	CL, CH	A-6, A-7	0	0	100	100	95-100	80-95	25-55	10-30
	11-21	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	0	100	100	90-100	70-95	25-55	10-30
	21-60	Silt loam, silty clay loam, loam.	CL, CH	A-6, A-7	0	0	100	100	90-100	70-95	25-55	10-30
111:												
Hangaard---------	0-8	Sandy loam-----	SM	A-2, A-4	0	0-3	95-100	80-100	50-75	20-45	---	NP
	8-14	Loamy sand, coarse sandy loam, loamy coarse sand.	SP-SM, SM	A-3, A-1, A-2	0	2-5	80-100	60-95	35-70	5-25	---	NP
	14-60	Gravelly coarse sand, gravelly sand, coarse sand.	SP-SM, SP	A-3, A-1, A-2	0	2-5	70-95	55-90	30-60	0-10	---	NP
116:												
Redby------------	0-6	Loamy fine sand	SM, SP-SM	A-2, A-3	0	0	100	95-100	85-95	5-25	0-14	NP
	6-36	Fine sand, sand	SM, SP-SM	A-3, A-2	0	0	100	95-100	80-95	5-20	0-14	NP
	36-60	Fine sand, sand	SP, SP-SM	A-3, A-2	0	0	100	95-100	80-95	2-12	0-14	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
117:												
Cormant----------	0-8	Loamy fine sand	SM, SP-SM	A-2, A-4, A-3	0	0	100	100	80-100	5-40	0-14	NP
	8-60	Fine sand, sand, loamy fine sand.	SP, SM, SP-SM	A-2, A-3	0	0	100	100	75-100	1-20	0-14	NP
145:												
Enstrom----------	0-7	Loamy fine sand	SM, SP-SM	A-2	0	0	100	95-100	80-95	10-25	---	NP
	7-25	Fine sand, sand, loamy sand.	SP-SM, SM	A-2, A-3	0	0-3	95-100	80-100	60-95	5-15	---	NP
	25-60	Fine sandy loam, loam, silty clay loam.	CL-ML, CL, SC, SC-SM	A-4, A-6	0	0-2	90-100	80-95	65-90	35-80	20-40	5-15
148:												
Poppleton--------	0-6	Fine sand-------	SP-SM, SM	A-3, A-2	0	0	100	100	80-95	5-25	---	NP
	6-60	Fine sand, sand	SM, SP	A-3, A-2	0	0	100	100	80-95	3-15	---	NP
157A:												
Wahpeton---------	0-35	Silty clay------	CH	A-7	0	0	100	100	95-100	80-95	50-75	25-50
	35-60	Clay, silty clay, silty clay loam.	CH, CL	A-7, A-6	0	0	100	100	95-100	80-95	35-75	20-50
157B:												
Wahpeton---------	0-22	Silty clay------	CH	A-7	0	0	100	100	95-100	80-95	50-75	25-50
	22-60	Clay, silty clay, silty clay loam.	CH, CL	A-7, A-6	0	0	100	100	95-100	80-95	35-75	20-50
184A:												
Hamerly----------	0-9	Loam------------	CL, CL-ML	A-4, A-6	0	0-5	95-100	90-100	80-95	60-90	20-40	5-20
	9-16	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	85-95	80-95	60-75	20-40	5-20
	16-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	85-95	80-95	60-75	20-40	5-20
187:												
Haug-------------	0-10	Muck------------	PT	A-8	0	0	0	0	0	0	---	NP
	10-18	Mucky sandy loam, fine sandy loam, loam.	OL, ML, CL, SM	A-4, A-6	0	0-3	95-100	90-100	70-85	35-65	15-40	1-15
	18-60	Loam, sandy loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	0-3	95-100	70-100	60-95	35-65	15-40	1-15

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
205:												
Karlstad--------	0-12	Loamy sand-----	SM, SP-SM	A-2, A-3	0-5	0-5	95-100	95-100	75-95	5-35	15-25	NP-4
	12-16	Coarse sandy loam, sandy loam, fine sandy loam.	SM, SC, SC-SM	A-2, A-4	0-5	0-5	95-100	95-100	75-95	12-50	15-25	NP-10
	16-19	Gravelly coarse sandy loam, gravelly sandy loam, gravelly fine sandy loam.	SC, SM, SC-SM, SP-SM	A-2, A-1, A-3	0-5	0-25	65-95	50-75	25-50	10-30	15-25	NP-10
	19-60	Stratified gravelly coarse sand to loamy fine sand.	SP, SP-SM	A-1, A-2, A-3	0-5	0-25	60-100	35-100	20-80	10-55	---	NP
236:												
Vallers---------	0-9	Loam-----------	OL, ML	A-4	0	0	95-100	90-100	80-90	50-80	30-40	4-10
	9-15	Clay loam, silty clay loam, sandy clay loam.	CL	A-6	0	0	95-100	90-100	80-95	50-80	30-40	11-20
	15-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	85-95	60-85	20-40	5-20
242B:												
Marquette-------	0-7	Loamy sand-----	SP-SM, SM, SC-SM	A-2	0	0-5	90-100	85-100	50-75	10-35	0-20	NP-5
	7-13	Very gravelly fine sandy loam, very gravelly loam, very gravelly sandy loam.	SM, SC, GM, GC	A-2, A-1	0	0-15	45-85	20-55	10-45	5-35	0-30	NP-10
	13-60	Very gravelly sand, coarse sand, very gravelly loamy coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0	0-10	45-95	20-80	10-70	0-20	0-14	NP
258B:												
Sandberg--------	0-12	Loamy sand-----	SM, SP-SM	A-1, A-2	0-3	0-5	85-100	50-95	40-75	10-25	---	NP-4
	12-60	Gravelly coarse sand, coarse sand, sand.	SP, SP-SM	A-1, A-3, A-2	0-3	0-5	60-95	50-95	30-65	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
280:												
Pelan-----------	0-6	Sandy loam-----	SM, SC-SM	A-2, A-4	0	2-4	95-100	75-100	55-90	30-50	0-20	NP-5
	6-12	Very gravelly sandy loam, very gravelly sandy clay loam.	SM, GM, SC, GC	A-2, A-1	0	2-4	45-85	25-50	5-45	12-35	20-30	NP-10
	12-24	Very gravelly coarse sand, very gravelly fine sandy loam.	SP-SM, SP, GP, GP-GM	A-1, A-3, A-2	0	2-4	40-85	25-50	5-50	1-10	0-14	NP
	24-60	Fine sandy loam, sandy loam, loam.	SM, ML, CL, SC	A-4, A-6	0	1-5	90-100	85-95	60-90	40-65	10-30	1-15
372:												
Hamar-----------	0-7	Loamy fine sand	SM, SC-SM	A-2, A-4	0	0	100	100	85-100	15-40	0-25	NP-5
	7-20	Loamy fine sand, loamy sand, fine sand.	SM, SC-SM, SP-SM	A-2, A-4	0	0	100	100	70-100	10-40	0-25	NP-5
	20-60	Fine sand, loamy sand, loamy fine sand.	SM, SC-SM, SP-SM	A-2	0	0	100	100	70-100	10-35	0-25	NP-5
379:												
Percy-----------	0-8	Loam-----------	SC, CL, SC-SM, CL-ML	A-4, A-6	0	0-1	90-100	85-100	70-95	35-70	20-40	5-15
	8-13	Gravelly fine sandy loam, gravelly sandy loam, gravelly loam.	SC-SM, SM, GM	A-2, A-4	0-1	0-5	80-95	50-85	30-80	15-65	10-20	1-10
	13-20	Loam, fine sandy loam, sandy loam.	CL, CL-ML	A-4	0-1	1-5	85-100	85-98	55-90	35-70	20-30	5-10
	20-60	Loam, fine sandy loam, sandy loam.	SC-SM, SC, CL-ML, CL	A-4	0-1	1-5	85-100	85-98	55-90	35-70	0-30	3-10
383:												
Percy-----------	0-8	Loam-----------	SC, CL, SC-SM, CL-ML	A-4, A-6	0	0-1	90-100	85-100	70-95	35-70	20-40	5-15
	8-11	Gravelly fine sandy loam, gravelly sandy loam, gravelly loam.	SC-SM, SM, GM	A-2, A-4	0-1	0-5	80-95	50-85	30-80	15-65	10-20	1-10
	11-35	Loam, fine sandy loam, sandy loam.	CL, CL-ML	A-4	0-1	1-5	85-100	85-98	55-90	35-70	20-30	5-10
	35-60	Loam, fine sandy loam, sandy loam.	SC-SM, SC, CL-ML, CL	A-4	0-1	1-5	85-100	85-98	55-90	35-70	0-30	3-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
384: Percy-----------	0-4	Mucky loam-----	CL-ML, CL	A-4, A-6	0	0-1	95-100	85-100	75-95	60-75	15-35	5-15
	4-18	Loam, clay loam, fine sandy loam.	CL	A-6, A-7	0-1	1-5	85-100	85-98	65-95	35-75	30-45	10-20
	18-60	Loam, fine sandy loam, sandy loam.	SM, SC, ML, CL	A-4	0-1	1-5	85-100	85-98	55-90	35-70	15-30	3-10
387: Roliss----------	0-9	Loam-----------	CL, CL-ML	A-4, A-6	0	0	95-100	80-100	80-100	60-90	20-40	5-20
	9-17	Loam, clay loam, silty clay loam.	CL	A-6, A-7	0	0	95-100	80-100	80-90	60-80	20-50	10-30
	17-60	Loam, clay loam	CL, CL-ML	A-6, A-7, A-4	0	0	95-100	80-98	80-95	60-80	20-50	5-30
412: Mavie-----------	0-10	Fine sandy loam	SM	A-2, A-4	0	0-3	95-100	85-100	55-85	30-50	0-30	NP-7
	10-16	Loam, fine sandy loam, sandy loam.	CL-ML, CL, SC, SC-SM	A-4, A-6	0	2-5	95-100	85-100	70-95	40-75	20-35	5-15
	16-27	Very gravelly coarse sand, very gravelly sand, very gravelly loamy sand.	SP-SM, SP, GP, GP-GM	A-1	0	2-5	30-65	15-55	10-30	1-10	0-14	NP
	27-60	Loam, silt loam, clay loam.	ML, CL, CL-ML	A-4, A-6	0	1-5	95-100	75-90	70-85	50-75	20-40	2-15
418: Lamoure---------	0-21	Silty clay loam	CL, CH, MH, ML	A-7	0	0	100	100	95-100	85-100	40-70	15-35
	21-42	Silty clay loam, silt loam.	CL, CH, MH, ML	A-7	0	0	100	100	90-100	60-100	40-70	15-35
	42-60	Stratified sandy loam to silty clay loam.	CL, SC	A-6, A-7	0	0	95-100	95-100	70-95	35-90	30-70	10-35
426: Foldahl---------	0-13	Loamy fine sand	SM, SP-SM	A-2	0	0	100	95-100	70-85	12-35	0-14	NP
	13-33	Fine sand, loamy fine sand, sand.	SP-SM, SM	A-2, A-3	0-1	0-3	95-100	90-100	70-85	5-35	0-14	NP
	33-60	Loam, clay loam, sandy loam.	CL-ML, CL, SC-SM, SC	A-4, A-6	0-1	1-5	95-100	75-95	70-90	40-85	15-40	5-20
429A: Northcote-------	0-10	Clay-----------	CH	A-7	0	0	100	100	95-100	95-100	65-80	35-45
	10-29	Clay-----------	MH, CH	A-7	0	0	100	100	95-100	90-100	65-85	30-50
	29-60	Clay-----------	CH	A-7	0	0	100	100	95-100	90-100	65-85	40-60

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
432: Strandquist	0-10	Loam	CL-ML, CL, SC-SM, SC	A-4, A-6	0	1-2	95-100	95-100	75-90	45-70	20-40	5-20
	10-30	Gravelly sand, gravelly coarse sand, very gravelly sand.	SP, GP, GP-GM, SP-SM	A-1	0	2-5	40-75	25-65	15-50	0-5	---	NP
	30-60	Silty clay loam, loam, sandy loam.	CL-ML, CL, SC, SC-SM	A-4, A-6	0	1-2	95-100	80-100	65-90	35-80	20-40	5-20
435: Syrene	0-10	Sandy loam	SM, SC, SC-SM	A-4	0-1	0-3	95-100	85-100	55-70	35-50	15-35	NP-10
	10-19	Loam, sandy loam, sandy clay loam.	SM, ML	A-4	0-1	0-3	95-100	85-100	55-75	35-65	20-40	1-10
	19-60	Stratified loamy fine sand to gravelly coarse sand.	SP-SM, SP	A-3, A-1, A-2	0-3	2-5	75-95	55-80	30-60	0-10	0-14	NP
439: Strathcona	0-9	Fine sandy loam	SM, SC-SM	A-2, A-4	0	0	100	95-100	65-85	30-50	20-30	5-10
	9-15	Fine sandy loam, sandy loam, loamy fine sand.	SM, SC-SM	A-2, A-4	0	0	100	95-100	65-85	30-50	20-30	5-10
	15-32	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-1, A-2	0	0-1	95-100	85-100	60-80	10-30	0-14	NP
	32-60	Fine sandy loam, loam, clay loam.	CL, CL-ML	A-4, A-6	0	0-1	95-100	85-98	70-90	50-70	25-40	5-20
481: Kratka	0-9	Fine sandy loam	SM, SC-SM	A-4	0	0	95-100	90-100	50-80	36-50	0-25	NP-6
	9-26	Loamy sand, sand, loamy fine sand.	SP-SM	A-3, A-2	0	0	95-100	90-100	50-80	5-10	0-14	NP
	26-60	Loam, clay loam, sandy loam.	SC-SM, SC, CL-ML, CL	A-4, A-6	0	0	95-100	90-100	70-90	40-60	15-40	5-25
482: Grygla	0-7	Loamy fine sand	SM, SC-SM	A-2	0	0	100	100	85-95	15-35	0-25	NP-7
	7-33	Sand, fine sand, loamy fine sand.	SP-SM, SM, SC-SM	A-2, A-3	0	0	95-100	90-100	70-95	5-35	0-20	NP-5
	33-60	Loam, fine sandy loam, silt loam.	CL-ML, CL	A-4, A-6	0	0-3	95-100	80-100	70-85	50-70	20-40	5-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
514:												
Tacoosh----------	0-29	Muck------------	PT	A-8	0	0-10	0	0	0	0	---	NP
	29-36	Mucky peat------	PT	A-8	0-5	0-10	0	0	0	0	---	NP
	36-60	Sandy loam, loam, clay loam.	SM, ML, SC, CL	A-2, A-4, A-6	0-5	0-10	85-100	85-95	65-95	25-75	15-35	NP-20
540:												
Seelyeville------	0-8	Muck------------	PT	A-8	0	0	0	0	0	0	---	NP
	8-60	Muck, mucky peat.	PT	A-8	0	0	0	0	0	0	---	NP
541:												
Rifle------------	0-6	Mucky peat------	PT	A-8	0	0	0	0	0	0	---	NP
	6-60	Mucky peat------	PT	A-8	0	0	0	0	0	0	---	NP
543:												
Markey-----------	0-25	Muck------------	PT	A-8	0	0	0	0	0	0	---	NP
	25-60	Fine sand, loamy sand, coarse sand.	SP, SM, SP-SM	A-2, A-3	0	0	100	75-100	60-75	0-20	0-14	NP
544:												
Cathro-----------	0-11	Muck------------	PT	A-8	0	0	0	0	0	0	---	NP
	11-25	Sapric material	PT	A-8	0	0	0	0	0	0	---	NP
	25-60	Sandy loam, loam, clay loam.	CL-ML, SC-SM, SC, CL	A-4, A-6	0	0-5	85-100	75-100	60-100	35-90	20-40	5-20
546:												
Lupton-----------	0-12	Muck------------	PT	A-8	0	0	0	0	0	0	---	NP
	12-60	Sapric material	PT	A-8	0	0	0	0	0	0	---	NP
547:												
Deerwood---------	0-11	Muck------------	PT	A-8	0	0	0	0	0	0	---	NP
	11-15	Fine sand, loamy sand, fine sandy loam.	SM, SP-SM	A-2, A-4	0	0-5	95-100	90-100	50-75	12-50	0-20	NP-4
	15-60	Fine sand, sand, gravelly sand.	SM, SP, SP-SM	A-2, A-3, A-1	0	0-5	75-100	55-100	35-70	1-25	0-14	NP
550:												
Dora-------------	0-23	Muck------------	PT	A-8	0	0	0	0	0	0	---	NP
	23-31	Sapric material	PT	A-8	0	0	0	0	0	0	---	NP
	31-60	Silty clay loam, silty clay, clay.	CH, CL	A-7	0	0	100	100	90-100	90-100	45-70	25-40
563:												
Northwood--------	0-12	Muck------------	PT	A-8	0	0	0	0	0	0	---	NP
	12-20	Fine sandy loam, loamy fine sand, loamy sand.	SM, SC-SM	A-2, A-4	0	0-3	95-100	90-100	51-85	15-50	0-35	NP-10
	20-34	Coarse sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	0-3	95-100	80-100	70-95	5-35	0-14	NP
	34-60	Loam, clay loam, fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	0-3	95-100	90-100	75-100	50-80	20-40	3-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
565:												
Eckvoll----------	0-8	Loamy fine sand	SM, SC-SM	A-4, A-2	0	0-2	90-100	85-100	45-80	25-40	15-20	NP-7
	8-28	Fine sand, sand, loamy fine sand.	SM, SP-SM	A-1, A-2, A-3	0	0-2	90-100	85-100	45-75	5-30	15-20	NP-4
	28-33	Clay loam, sandy clay loam, loam.	SC, CL	A-4, A-6, A-7	0	0-5	90-100	85-98	65-95	45-75	25-50	7-25
	33-60	Loam, clay loam, fine sandy loam.	CL	A-4, A-6, A-7	0	0-5	90-100	85-98	70-95	50-80	25-45	7-20
582:												
Roliss-----------	0-12	Loam------------	CL, CL-ML	A-4, A-6	0	0	95-100	80-100	80-100	60-90	20-40	5-20
	12-17	Loam, clay loam, silty clay loam.	CL	A-6, A-7	0	0	95-100	80-100	80-90	60-80	20-50	10-30
	17-60	Loam, clay loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	0	95-100	80-100	80-95	60-80	20-50	5-30
583:												
Nereson----------	0-10	Fine sandy loam	SM	A-4	0	0-5	90-100	80-98	50-70	35-50	15-20	NP-4
	10-18	Loam, fine sandy loam, sandy loam.	SM, ML, CL-ML, CL	A-4	0	0-5	90-100	80-98	55-90	40-60	20-28	4-9
	18-20	Gravelly loam, gravelly fine sandy loam, gravelly sandy loam.	GM, SM	A-1, A-2	0-1	1-5	80-95	50-78	25-75	5-40	10-20	1-10
	20-33	Sandy loam, loam, gravelly loam.	SM, ML, CL, CL-ML	A-4, A-6	0-1	1-5	85-95	75-95	45-85	10-55	15-30	1-15
	33-60	Sandy loam, loam, gravelly loam.	SM, ML, CL, CL-ML	A-4, A-6	0-1	1-5	85-95	75-95	45-85	10-55	15-30	1-15
630:												
Wildwood---------	0-9	Muck------------	PT	A-8	0	0	0	0	0	0	---	NP
	9-18	Clay, silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	85-98	75-90	50-65
	18-60	Clay, silty clay.	CH	A-7	0	0	100	85-100	85-100	60-95	65-90	40-65
641:												
Clearwater-------	0-10	Clay------------	CL, CH	A-7	0	0-1	95-100	90-97	80-95	70-95	45-80	20-50
	10-20	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	0-1	95-100	90-97	80-95	70-95	40-80	20-50
	20-60	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	0-1	95-100	90-100	80-97	75-95	40-80	20-50

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
642:												
Clearwater------	0-8	Loam-----------	SC-SM, SM, ML, CL-ML	A-4, A-6	0	0-1	95-100	90-97	65-85	45-65	20-35	NP-11
	8-20	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	0-1	95-100	90-97	80-95	70-95	40-80	20-50
	20-60	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	0-1	95-100	90-100	80-97	75-95	40-80	20-50
643:												
Huot------------	0-9	Fine sandy loam	SM, SC-SM	A-4	0	0	90-100	75-100	50-85	25-55	15-30	NP-8
	9-16	Loamy fine sand, fine sandy loam.	SM, SC-SM	A-2, A-4	0	0	90-100	75-100	60-85	25-55	15-30	NP-8
	16-29	Loamy fine sand, fine sand.	SP-SM, SM	A-2, A-3	0	0	90-100	75-100	50-80	15-35	0-20	NP
	29-60	Clay, silty clay, silty clay loam.	CH	A-7	0	0-1	95-100	85-100	85-100	70-95	60-80	35-50
644:												
Boash-----------	0-7	Clay loam------	CL	A-7	0	0-2	95-100	90-100	80-100	70-95	40-50	20-25
	7-33	Clay, silty clay loam, silty clay.	CH, CL	A-7	0	0-2	95-100	90-100	80-100	70-95	45-80	25-50
	33-60	Loam, clay loam, sandy loam.	CL, CL-ML	A-4, A-6	0	1-3	95-100	85-98	70-95	50-80	24-35	6-15
645:												
Espelie---------	0-10	Fine sandy loam	SM, ML, SC, CL	A-4, A-2	0	0	95-100	85-100	60-85	30-65	0-25	NP-8
	10-34	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM	A-2, A-4, A-1	0	0-5	85-100	60-100	30-80	10-40	0-20	NP-4
	34-60	Clay, silty clay, clay loam.	CH, CL	A-7	0	1-3	90-100	85-100	80-100	70-100	40-65	20-40
647:												
Hilaire---------	0-11	Loamy fine sand	SM, ML, SC-SM, CL-ML	A-2, A-4	0	0	90-100	75-100	50-85	20-55	15-20	NP-7
	11-22	Loamy sand, loamy fine sand, sand.	SM, SP-SM	A-1, A-2, A-4	0	0-2	85-100	75-100	45-85	10-40	15-20	NP-4
	22-34	Gravelly loamy sand, loamy sand, sand.	SM, SP-SM	A-1, A-2	0	0-5	85-100	65-100	30-70	10-30	15-20	NP-4
	34-60	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	1-3	95-100	85-100	75-95	65-90	40-70	20-45

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
648:												
Newfolden--------	0-7	Loam------------	CL-ML	A-4, A-6	0	0	100	95-100	85-95	60-75	20-35	4-15
	7-16	Clay, silty clay, silty clay loam.	CH, CL	A-4, A-7	0	0	100	100	90-100	80-95	50-65	25-40
	16-36	Loam, clay loam	CL-ML, CL	A-4, A-6	0	0-3	95-100	95-100	85-100	36-60	25-45	6-20
	36-60	Loam, clay loam, silt loam.	CL-ML, CL, ML	A-4, A-6	0	0-3	95-100	95-100	80-85	36-60	25-45	6-20
649:												
Reiner-----------	0-10	Loamy fine sand	SM	A-2, A-4	0	0-5	85-100	75-95	60-90	30-45	15-20	NP-4
	10-16	Clay loam, loam, sandy clay loam.	CL	A-6, A-7, A-4	0	0-3	85-100	75-100	60-95	55-80	25-50	7-25
	16-60	Loam, clay loam, fine sandy loam.	CL, ML, CL-ML	A-4, A-6	0	0-3	85-100	75-100	55-100	50-80	25-45	3-20
650:												
Reiner-----------	0-9	Fine sandy loam	SM, ML	A-4	0	0-5	85-100	75-100	55-85	35-55	15-35	NP-10
	9-16	Clay loam, loam, sandy clay loam.	CL	A-6, A-7, A-4	0	0-3	85-100	75-100	60-95	55-80	25-50	7-25
	16-60	Loam, clay loam, fine sandy loam.	CL, ML, CL-ML	A-4, A-6	0	0-3	85-100	75-100	55-100	50-80	25-45	3-20
651:												
Thiefriver-------	0-8	Fine sandy loam	ML, SM, SC-SM, CL-ML	A-4	0	0	95-100	80-100	70-90	35-55	15-30	NP-10
	8-15	Loamy fine sand, fine sandy loam, loamy sand.	ML, SM, SC-SM, CL-ML	A-2, A-4	0	0	95-100	80-100	60-90	10-55	15-30	NP-10
	15-31	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM	A-2, A-3	0	0-3	90-100	80-100	50-80	5-35	---	NP
	31-60	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	0-3	100	95-100	95-100	90-100	40-70	20-40
652:												
Wyandotte--------	0-8	Clay loam-------	CL	A-6	0	0-3	95-100	85-100	70-95	50-70	30-40	10-15
	8-15	Loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0	0-3	95-100	80-95	60-95	50-65	25-40	6-16
	15-29	Gravelly loamy coarse sand, gravelly sand, gravelly coarse sand.	SM, SP, GP, GM	A-1	0	2-5	20-60	15-50	10-30	0-15	0-14	NP
	29-60	Clay, silty clay loam, silty clay.	CH, CL	A-7	0	1-3	85-100	80-100	75-100	65-95	40-90	20-60

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
653:												
Smiley----------	0-2	Mucky loam-----	ML, CL, CL-ML	A-4, A-6	0-1	0-2	95-100	85-100	60-90	50-80	0-35	2-12
	2-8	Loam, fine sandy loam, sandy clay loam.	SC-SM, SM, ML, CL-ML	A-4, A-6	0-1	0-2	95-100	85-100	75-95	35-70	0-35	2-12
	8-21	Clay loam, sandy clay loam, loam.	CL	A-6, A-7	0-1	0-2	95-100	85-100	70-95	50-80	25-50	10-25
	21-60	Loam, fine sandy loam, clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0-1	0-2	95-100	85-100	70-95	40-80	25-40	6-18
708:												
Rushlake---------	0-8	Loamy sand-----	SM, SP-SM	A-1-b, A-2-4	0	0	95-100	75-100	15-60	10-35	---	NP
	8-60	Gravelly sand, gravelly loamy sand, sand.	SP, SP-SM	A-1-b, A-3	0	0-3	55-95	50-90	15-60	2-10	---	NP
712:												
Rosewood---------	0-12	Fine sandy loam	SM, SC, SC-SM	A-2, A-4	0	0	100	97-100	65-90	30-50	0-30	NP-10
	12-22	Fine sandy loam, loamy fine sand, sandy loam.	SM, SC, SC-SM	A-2, A-4	0	0	100	95-100	60-85	25-45	0-30	NP-10
	22-60	Fine sand, sand	SM, SP-SM	A-1, A-2, A-3	0	0	85-100	75-95	45-75	5-25	0-14	NP
713:												
Linveldt---------	0-13	Fine sandy loam	SC-SM, SM	A-2, A-4	0	0-5	95-100	80-100	55-90	20-50	15-25	2-7
	13-19	Sandy clay loam, loam, sandy loam.	SC-SM, CL-ML, CL, SC	A-2, A-6, A-4	0-1	0-5	95-100	80-100	50-90	25-75	25-40	6-15
	19-31	Loamy sand, sand, coarse sand.	SM, SP-SM, SC-SM	A-2, A-1, A-3	0-1	0-5	65-100	55-100	30-80	5-30	0-20	NP-5
	31-60	Loam, clay loam, fine sandy loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0-1	0-3	90-100	80-100	60-90	40-70	25-40	6-20
721B:												
Corliss----------	0-7	Loamy sand-----	SM, SP-SM	A-1-b, A-2-4	0	0-5	85-100	80-100	40-70	10-25	15-21	NP-4
	7-12	Loamy sand, gravelly sand, coarse sand.	SP-SM, SM, SP	A-1-b, A-2-4, A-3	0	0-5	75-95	50-85	35-70	2-25	15-21	NP-4
	12-60	Coarse sand, sand, gravelly coarse sand.	SP, SP-SM	A-1-b, A-3	0	0-5	60-95	50-85	30-65	2-10	---	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
765:												
Smiley	0-9	Loam	ML, CL, CL-ML	A-4, A-6	0-1	0-2	95-100	85-100	75-95	50-80	15-35	2-12
	9-16	Clay loam, loam, silty clay loam.	CL, ML	A-6, A-7	0-1	0-2	95-100	85-100	70-95	50-80	25-50	10-25
	16-60	Loam, fine sandy loam, clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0-1	0-2	95-100	85-100	70-95	40-80	25-40	6-18
794:												
Clearriver	0-9	Loamy fine sand	SM, SP-SM	A-2	0	0	95-100	85-100	75-90	10-35	15-25	NP-10
	9-14	Sand, loamy sand.	SP-SM, SM	A-2, A-3	0	0	95-100	85-100	55-80	5-20	---	NP
	14-60	Stratified fine sand to gravelly coarse sand.	SP-SM, SP	A-2, A-3, A-1	0	0-2	75-100	65-85	40-65	0-10	---	NP
935:												
Hegne	0-8	Silty clay	CH	A-7	0	0	100	100	95-100	90-98	50-70	25-40
	8-23	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	95-98	50-70	25-40
	23-60	Clay, silty clay.	CH	A-7	0	0	100	100	95-100	95-100	50-70	25-45
Fargo	0-15	Silty clay	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50
	15-31	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50
	31-60	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50
936:												
Clearwater	0-9	Loam	SC-SM, SM, ML, CL-ML	A-4, A-6	0	0-1	95-100	90-97	65-85	45-65	20-35	NP-11
	9-30	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	0-1	95-100	90-97	80-95	70-95	40-80	20-50
	30-60	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	0-1	95-100	90-100	80-97	75-95	40-80	20-50
Reis	0-7	Clay loam	CL	A-6	0	0-1	95-100	90-99	80-95	65-90	35-50	15-25
	7-21	Clay, silty clay.	CH, MH	A-7	0	0-1	95-100	90-99	80-97	75-90	50-80	20-50
	21-60	Clay, silty clay.	CH, MH	A-7	0	0-1	95-100	90-99	80-95	75-90	50-80	20-50
937:												
Eaglepoint	0-10	Clay	CH	A-7	0	0	100	100	90-100	75-95	75-85	45-60
	10-29	Clay	CH	A-7	0	0	100	100	90-100	75-95	75-85	45-60
	29-48	Silty clay, clay.	CH	A-7	0	0	100	100	90-100	75-95	70-85	40-60
	48-60	Silty clay, clay.	CH	A-7	0	0	100	100	90-100	75-95	70-85	40-60
Northcote	0-13	Clay	CH	A-7	0	0	100	100	95-100	95-100	65-80	35-45
	13-23	Clay	MH, CH	A-7	0	0	100	100	95-100	90-100	65-85	30-50
	23-60	Clay	CH	A-7	0	0	100	100	95-100	90-100	65-85	40-60

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
972:												
Roliss----------	0-9	Loam-----------	CL, CL-ML	A-4, A-6	0	0	95-100	80-100	80-100	60-90	20-40	5-20
	9-17	Loam, clay loam, silty clay loam.	CL	A-6, A-7	0	0	95-100	80-100	80-90	60-80	20-50	10-30
	17-60	Loam, clay loam, silty clay loam.	CL, CL-ML	A-6, A-7, A-4	0	0	95-100	80-100	80-95	60-80	20-50	5-30
Vallers---------	0-9	Loam-----------	OL, ML	A-4	0	0	95-100	90-100	80-90	50-80	30-40	4-10
	9-15	Clay loam, silty clay loam, sandy clay loam.	CL	A-6	0	0	95-100	90-100	80-95	50-80	30-40	11-20
	15-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	85-95	60-85	20-40	5-20
1006:												
Fluvaquents-----	0-4	Very fine sandy loam.	ML, SM	A-4	0	0	100	90-100	75-100	45-80	15-35	NP-10
	4-60	Stratified loamy sand to silt loam.	ML, CL, SM, SC	A-2, A-4, A-6, A-7	0	0	95-100	85-100	45-95	20-80	20-45	3-20
Haploborolls----	0-11	Clay loam------	CL	A-4, A-6, A-7	0	0	100	100	90-100	75-100	25-50	7-25
	11-60	Clay loam, silt loam, sandy loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0	100	100	60-100	36-90	25-40	5-20
1030:												
Pits.												
Udipsamments----	0-14	Sand-----------	SM, SP-SM	A-2	0	0	95-100	85-100	75-90	10-35	---	NP
	14-60	Sand, fine sand	SP-SM, SP	A-2, A-3	0	0	95-100	85-100	50-75	5-25	---	NP
1031:												
Seelyeville-----	0-14	Muck-----------	PT	A-8	0	0	0	0	0	0	---	NP
	14-60	Mucky peat, muck.	PT	A-8	0	0	0	0	0	0	---	NP
1143:												
Berner----------	0-33	Muck-----------	PT	A-8	0	0	0	0	0	0	---	NP
	33-44	Sand, loamy sand, gravelly sand.	SP, SM, SP-SM	A-2, A-3, A-1	0	0	90-100	70-100	60-80	0-25	---	NP
	44-60	Loam, clay loam, silt loam.	ML, CL	A-4, A-6	0	0	95-100	85-100	60-90	50-80	30-40	10-20
Markey----------	0-29	Muck-----------	PT	A-8	0	0	0	0	0	0	---	NP
	29-60	Fine sand, loamy sand, coarse sand.	SP, SM, SP-SM	A-2, A-3	0	0	100	75-100	60-75	0-20	0-14	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1144:												
Strathcona------	0-10	Mucky fine sandy loam.	SM	A-4	0	0	100	95-100	65-85	30-50	20-30	5-10
	10-16	Fine sandy loam, sandy loam.	SM, SC-SM	A-2, A-4	0	0	100	95-100	65-85	30-50	20-30	5-10
	16-30	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-1, A-2	0	0-1	95-100	85-100	60-80	10-30	0-14	NP
	30-60	Fine sandy loam, loam, clay loam.	CL, CL-ML	A-4, A-6	0	0-1	95-100	85-98	70-90	50-70	25-40	5-20
Kratka----------	0-9	Mucky fine sandy loam.	OL, SP	A-2-4, A-4	0	0	95-100	90-100	50-80	20-50	0-20	NP
	9-26	Loamy sand, loamy fine sand, sand.	SP-SM	A-3, A-2	0	0	95-100	90-100	50-80	5-10	0-14	NP
	26-80	Loam, clay loam, sandy loam.	SC-SM, SC, CL-ML, CL	A-4, A-6	0	0	95-100	90-100	70-90	40-60	15-40	5-25
1146:												
Northwood-------	0-15	Muck-----------	PT	A-8	0	0	0	0	0	0	---	NP
	15-21	Fine sandy loam, loamy fine sand, loamy sand.	SM, SC-SM	A-2, A-4	0	0-3	95-100	90-100	45-95	15-50	15-30	NP-10
	21-28	Coarse sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	0-3	95-100	80-100	40-95	5-50	0-20	NP-5
	28-60	Loam, clay loam, fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	0-3	95-100	90-100	65-100	35-80	20-40	3-20
1158:												
Skagen----------	0-7	Loam-----------	CL-ML, ML, CL	A-4	0	0-1	95-100	85-100	75-95	55-75	20-30	5-10
	7-10	Gravelly loam, gravelly fine sandy loam.	SC-SM, SM, SC	A-2, A-4	0	0-5	60-85	50-85	35-75	20-55	20-30	5-10
	10-21	Loam, fine sandy loam, sandy loam.	SC-SM, CL-ML	A-2, A-4	0	0-5	85-100	85-98	55-90	35-70	20-30	5-10
	21-60	Loam, fine sandy loam, sandy loam.	SC-SM, CL-ML	A-2, A-4	0	0-5	85-100	85-98	55-90	35-70	20-30	5-10
1170:												
Skagen----------	0-10	Loam-----------	CL-ML, ML, CL	A-4	0	0-1	95-100	85-100	75-95	55-75	20-30	5-10
	10-13	Gravelly loam, gravelly fine sandy loam.	SC-SM, SM, SC	A-2, A-4	0	0-5	60-85	50-85	35-75	20-55	20-30	5-10
	13-19	Loam, fine sandy loam, sandy loam.	SC-SM, CL-ML	A-2, A-4	0	0-5	85-100	85-98	55-90	35-70	20-30	5-10
	19-60	Loam, fine sandy loam, sandy loam.	SC-SM, CL-ML	A-2, A-4	0	0-5	85-100	85-98	55-90	35-70	20-30	5-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1187:												
Dora------------	0-31	Muck-----------	PT	A-8	0	0	0	0	0	0	---	NP
	31-42	Mucky silt loam, mucky silty clay loam.	CH	A-7-6	0	0	100	100	90-100	75-95	40-55	20-35
	42-60	Silty clay loam, silty clay, clay.	CH, CL	A-7-6	0	0	100	100	90-100	75-95	50-75	30-50
1188:												
Wildwood---------	0-14	Muck-----------	PT	A-8	0	0	0	0	0	0	---	NP
	14-23	Clay, silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	85-98	75-90	50-65
	23-60	Clay, silty clay.	CH	A-7	0	0	100	85-100	85-100	60-95	65-90	40-65
1189:												
Clearwater------	0-7	Mucky loam-----	OL	A-7	0	0	95-100	90-97	80-95	60-75	25-35	10-15
	7-10	Clay-----------	CL, CH	A-6, A-7	0	0	95-100	90-97	65-95	50-95	35-75	15-45
	10-60	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	0	95-100	90-97	80-95	70-95	40-75	20-45
1191:												
Sahkahtay-------	0-4	Sandy loam-----	SM	A-2, A-4	0	0	85-100	80-100	55-85	25-40	15-25	NP-10
	4-8	Sand, loamy sand.	SM, SP-SM	A-2	0	0	85-100	80-100	50-85	5-25	0-14	NP
	8-14	Sandy loam, sandy clay loam, loam.	SC, CL	A-4, A-6	0	0-5	80-100	75-98	50-85	40-60	30-40	10-20
	14-60	Loamy sand, sand, gravelly coarse sand.	SW, SW-SM, SM	A-1, A-2-4	0	0-5	55-90	50-85	15-60	2-20	0-14	NP
1264:												
Ulen------------	0-10	Loamy fine sand	SM	A-4, A-2	0	0	100	100	80-100	20-50	0-20	NP-4
	10-21	Loamy fine sand, fine sand.	SM	A-2	0	0	100	95-100	70-95	12-35	0-14	NP
	21-60	Fine sand------	SP-SM, SM	A-3, A-2	0	0	100	95-100	80-100	5-35	0-14	NP
1297:												
Augsburg--------	0-9	Very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	0	100	100	95-100	50-90	15-40	NP-5
	9-29	Loamy very fine sand, very fine sandy loam, loam.	ML	A-4	0	0	100	100	95-100	80-90	20-40	NP-10
	29-60	Silty clay, clay, silty clay loam.	CH	A-7	0	0	95-100	95-100	95-100	95-100	35-85	35-55

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1299:												
Borup	0-8	Very fine sandy loam.	ML	A-4	0	0	100	100	90-100	60-80	20-30	NP-7
	8-21	Very fine sandy loam, silt loam, sandy clay loam.	ML	A-4	0	0	100	100	90-100	60-95	0-30	NP-5
	21-60	Loamy very fine sand, very fine sand, very fine sandy loam.	ML	A-4	0	0	100	100	85-100	50-90	0-30	NP-5
1304A:												
Glyndon	0-9	Very fine sandy loam.	ML, CL-ML	A-4	0	0	100	100	95-100	70-95	20-30	NP-5
	9-60	Loamy very fine sand, very fine sand, very fine sandy loam.	ML, SM, SC, CL	A-4	0	0	100	100	85-100	35-75	10-30	NP-10
1304B:												
Glyndon	0-8	Very fine sandy loam.	ML, CL-ML	A-4	0	0	100	100	95-100	70-95	20-30	NP-5
	8-17	Silt loam, very fine sandy loam, loam.	ML, CL, CL-ML	A-4	0	0	100	100	90-100	85-95	20-30	NP-10
	17-60	Loamy very fine sand, very fine sand, very fine sandy loam.	ML, SM, SC, CL	A-4	0	0	100	100	85-100	35-75	10-30	NP-10
1315A:												
Wheatville	0-9	Very fine sandy loam.	ML	A-4	0	0	100	100	95-100	50-100	0-14	NP
	9-29	Very fine sandy loam, silt loam, loamy very fine sand.	ML, CL, CL-ML	A-4	0	0	100	100	85-100	80-95	15-35	NP-10
	29-60	Clay, silty clay, silty clay loam.	CH, CL	A-7, A-6	0	0	100	100	95-100	90-100	35-80	15-45
1804:												
Hamre	0-9	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	9-21	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6, A-7	0-1	0-3	90-100	80-100	70-100	50-90	25-45	6-20
	21-60	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6, A-7	0-1	0-3	80-100	75-100	65-95	50-85	25-45	6-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1807:												
Cathro	0-20	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	20-36	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	36-60	Sandy loam, silt loam, clay loam.	SC-SM, CL-ML, SC, CL	A-4, A-6	0	0-5	80-100	65-100	60-100	35-90	20-40	4-20
1808:												
Markey	0-40	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	40-60	Fine sand, loamy sand, coarse sand.	SP, SM, SP-SM	A-2, A-3	0	0	100	75-100	60-75	0-20	0-14	NP
1871:												
Fargo	0-12	Silty clay	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50
	12-37	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50
	37-60	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50
1874:												
Radium	0-14	Loamy sand	SM, SP-SM	A-2-4	0	0	95-100	95-100	50-70	5-20	0-15	NP
	14-33	Sand, loamy sand, gravelly loamy coarse sand.	SP, SM, SP-SM	A-1, A-2, A-3	0	0-5	75-100	65-95	35-60	3-15	0-15	NP
	33-43	Gravelly sand, gravelly coarse sand, very gravelly coarse sand.	GP, SP, SM, SP-SM	A-1	0	0-5	55-85	25-75	15-40	2-10	0-15	NP
	43-60	Sand, coarse sand, loamy sand.	SP, SM, SP-SM	A-1, A-2, A-3	0	0-5	75-90	75-90	40-80	2-10	---	NP
1878:												
Hamre	0-9	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	9-14	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6, A-7	0-1	0-3	90-100	80-100	70-100	50-90	25-45	6-20
	14-60	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6, A-7	0-1	0-3	80-100	75-100	65-95	50-85	25-45	6-20
1882:												
Rosewood	0-8	Fine sandy loam	SM, SC, SC-SM	A-2, A-4	0	0	100	95-100	65-85	30-50	0-30	NP-10
	8-27	Fine sandy loam, loamy fine sand, sandy loam.	SM, SC, SC-SM	A-2, A-4	0	0	100	95-100	60-85	25-45	0-30	NP-10
	27-60	Fine sand, sand	SM, SP-SM	A-1, A-2, A-3	0	0	85-100	75-95	45-75	5-25	0-14	NP

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1882:												
Strathcona------	0-9	Fine sandy loam	SM, SC, SC-SM	A-2, A-4	0	0	100	95-100	65-85	30-50	20-30	5-10
	9-21	Loamy sand, fine sand, loamy fine sand.	SM, SP-SM	A-2	0	0-1	95-100	85-100	60-80	10-30	0-14	NP
	21-60	Fine sandy loam, loam, clay loam.	CL, CL-ML	A-4, A-6	0	0-1	95-100	85-100	70-90	50-70	25-40	5-20
Berner----------	0-21	Muck-----------	PT	A-8	0	0	0	0	0	0	---	NP
	21-35	Sand, fine sand, gravelly sand.	SP, SM, SP-SM	A-2, A-3, A-1	0	0	90-100	70-100	60-80	0-25	---	NP
	35-60	Loam, clay loam, silt loam.	ML, CL	A-4, A-6	0	0	95-100	85-100	60-90	50-80	30-40	10-20
1963:												
Bearden---------	0-10	Silty clay loam	CL, CH	A-6, A-7	0	0	100	100	95-100	80-95	25-55	10-30
	10-17	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	0	100	100	90-100	70-95	25-55	10-30
	17-60	Silt loam, silty clay loam, loam.	CL, CH	A-6, A-7	0	0	100	100	90-100	70-95	25-55	10-30
Colvin----------	0-9	Silty clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-95	35-50	15-30
	9-21	Silt loam, silty clay loam.	CL	A-6, A-7	0	0	100	100	90-100	80-95	25-50	10-30
	21-60	Loam, silt loam, silty clay loam.	CL	A-6, A-7	0	0	100	100	90-100	70-95	25-50	10-25
1964:												
Colvin----------	0-11	Silty clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-95	35-50	15-30
	11-19	Silt loam, silty clay loam.	CL	A-6, A-7	0	0	100	100	90-100	80-95	25-50	10-30
	19-60	Loam, silt loam, silty clay loam.	CL	A-6, A-7	0	0	100	100	90-100	70-95	25-50	10-25
Fargo-----------	0-14	Silty clay-----	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50
	14-26	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50
	26-60	Silty clay, clay.	CH	A-7	0	0	100	100	95-100	85-100	50-75	25-50

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1966:												
Rosewood--------	0-11	Fine sandy loam	SM, SC, SC-SM	A-2, A-4	0	0	100	97-100	65-90	30-50	0-30	NP-10
	11-18	Fine sandy loam, loamy fine sand, sandy loam.	SM, SC, SC-SM	A-2, A-4	0	0	100	95-100	60-85	25-45	0-30	NP-10
	18-60	Fine sand, sand	SM, SP-SM	A-1, A-2, A-3	0	0	85-100	75-95	45-75	5-25	0-14	NP
Hamar-----------	0-16	Loamy fine sand	SM, SC-SM	A-2, A-4	0	0	100	100	85-100	15-40	0-25	NP-5
	16-60	Fine sand, loamy sand, loamy fine sand.	SM, SC-SM, SP-SM	A-2	0	0	100	100	70-100	10-35	0-25	NP-5

Physical Properties of the Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group
	In	Pct	g/cc	In/hr	In/in		Pct				
47:											
Colvin	0-9	27-34	1.20-1.50	0.20-0.60	0.20-0.22	Moderate	4.0-7.0	0.32	0.32	5	4L
	9-29	18-34	1.20-1.50	0.20-0.60	0.16-0.20	Moderate	0.0-5.0	0.32	0.32		
	29-60	18-34	1.30-1.50	0.20-0.60	0.15-0.20	Moderate	0.0-1.0	0.32	0.32		
57A:											
Fargo	0-11	40-60	1.10-1.30	0.06-0.20	0.15-0.18	High	4.0-10	0.32	0.32	5	4
	11-17	40-60	1.20-1.50	0.06-0.20	0.14-0.17	High	---	0.32	0.32		
	17-60	40-60	1.20-1.50	0.06-0.20	0.14-0.17	High	---	0.32	0.32		
58:											
Kittson	0-11	10-27	1.30-1.45	0.60-2.00	0.20-0.22	Low	4.0-6.0	0.24	0.24	5	5
	11-15	18-30	1.35-1.55	0.60-2.00	0.17-0.19	Low	1.0-3.0	0.32	0.32		
	15-60	18-30	1.40-1.65	0.20-2.00	0.15-0.18	Moderate	0.0-0.5	0.32	0.32		
59:											
Grimstad	0-10	10-18	1.30-1.45	2.00-6.00	0.13-0.18	Low	2.0-4.0	0.20	0.20	5	3
	10-29	2-15	1.45-1.60	6.00-20.00	0.08-0.14	Low	1.0-2.0	0.20	0.20		
	29-60	10-30	1.50-1.65	0.60-2.00	0.11-0.19	Low	0.0-0.5	0.37	0.37		
65:											
Foxhome	0-8	10-20	1.35-1.50	2.00-6.00	0.13-0.18	Low	3.0-7.0	0.20	0.20	3	3
	8-14	10-25	1.35-1.50	2.00-20.00	0.09-0.19	Low	1.0-3.0	0.17	0.24		
	14-26	5-15	1.50-1.70	6.00-20.00	0.02-0.07	Low	0.5-1.0	0.05	0.15		
	26-60	12-35	1.40-1.70	0.60-2.00	0.15-0.22	Low	0.0-0.5	0.32	0.37		
66:											
Flaming	0-15	2-10	1.40-1.55	6.00-20.00	0.11-0.13	Low	2.0-4.0	0.17	0.17	5	2
	15-60	2-10	1.50-1.70	6.00-20.00	0.06-0.10	Low	0.5-1.0	0.17	0.17		
67A:											
Bearden	0-9	10-26	1.20-1.40	0.60-2.00	0.20-0.24	Moderate	3.0-7.0	0.32	0.32	5	4L
	9-16	18-34	1.30-1.50	0.20-0.60	0.16-0.22	Moderate	1.0-4.0	0.37	0.37		
	16-60	18-34	1.30-1.80	0.20-0.60	0.16-0.22	Moderate	0.0-0.5	0.43	0.43		
67B:											
Bearden	0-8	10-26	1.20-1.40	0.60-2.00	0.20-0.24	Moderate	3.0-7.0	0.32	0.32	5	4L
	8-14	18-34	1.30-1.50	0.20-0.60	0.16-0.22	Moderate	1.0-4.0	0.37	0.37		
	14-60	18-34	1.30-1.80	0.20-0.60	0.16-0.22	Moderate	0.0-0.5	0.43	0.43		
77:											
Garnes	0-10	5-20	1.40-1.60	2.00-6.00	0.14-0.18	Low	0.5-2.0	0.32	0.32	5	3
	10-17	18-30	1.50-1.65	0.60-2.00	0.17-0.20	Moderate	0.5-1.0	0.32	0.32		
	17-60	10-27	1.60-1.75	0.60-2.00	0.14-0.19	Low	0.0-0.5	0.32	0.32		
93A:											
Bearden	0-11	27-39	1.20-1.40	0.20-0.60	0.17-0.23	Moderate	3.0-7.0	0.37	0.37	5	4L
	11-21	18-34	1.30-1.50	0.20-0.60	0.16-0.22	Moderate	1.0-4.0	0.37	0.37		
	21-60	18-34	1.30-1.80	0.20-0.60	0.16-0.22	Moderate	0.0-0.5	0.43	0.43		
111:											
Hangaard	0-8	8-18	1.25-1.45	2.00-6.00	0.10-0.14	Low	3.0-8.0	0.20	0.20	5	3
	8-14	5-15	1.50-1.70	6.00-20.00	0.07-0.11	Low	1.0-3.0	0.20	0.20		
	14-60	2-10	1.50-1.70	6.00-40.00	0.02-0.04	Low	0.0-0.5	0.10	0.15		

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group
								K	Kf	T	
	In	Pct	g/cc	In/hr	In/in		Pct				
116:											
Redby	0-6	2-10	1.40-1.60	6.00-20.00	0.08-0.12	Low	0.5-2.0	0.17	0.17	5	2
	6-36	1-8	1.55-1.70	6.00-20.00	0.07-0.10	Low	0.0-0.5	0.17	0.17		
	36-60	0-6	1.55-1.70	6.00-20.00	0.06-0.08	Low	0.0-0.5	0.17	0.17		
117:											
Cormant	0-8	3-10	1.30-1.50	6.00-20.00	0.08-0.12	Low	2.0-10	0.17	0.17	5	2
	8-60	0-5	1.50-1.70	6.00-20.00	0.06-0.10	Low	0.5-1.0	0.17	0.17		
145:											
Enstrom	0-7	4-15	1.30-1.50	6.00-20.00	0.10-0.12	Low	0.5-4.0	0.17	0.17	5	2
	7-25	1-12	1.40-1.65	6.00-20.00	0.06-0.08	Low	0.0-0.5	0.15	0.15		
	25-60	10-35	1.50-1.65	0.20-2.00	0.17-0.20	Moderate	0.0-0.5	0.37	0.37		
148:											
Poppleton	0-6	2-10	1.45-1.65	6.00-20.00	0.08-0.10	Low	1.0-3.0	0.15	0.15	5	1
	6-60	1-10	1.45-1.65	6.00-20.00	0.07-0.09	Low	0.0-0.5	0.15	0.15		
157A:											
Wahpeton	0-35	40-59	1.10-1.30	0.20-2.00	0.14-0.18	High	4.0-8.0	0.28	0.28	5	4
	35-60	35-59	1.10-1.40	0.20-2.00	0.13-0.17	High	0.0-2.0	0.28	0.28		
157B:											
Wahpeton	0-22	40-59	1.10-1.30	0.20-2.00	0.14-0.18	High	4.0-8.0	0.28	0.28	5	4
	22-60	35-59	1.10-1.40	0.20-2.00	0.13-0.17	High	0.0-2.0	0.28	0.28		
184A:											
Hamerly	0-9	18-27	1.20-1.60	0.60-2.00	0.20-0.24	Low	4.0-7.0	0.28	0.28	5	4L
	9-16	18-30	1.20-1.60	0.60-2.00	0.15-0.19	Low	0.5-1.0	0.28	0.32		
	16-60	18-30	1.30-1.60	0.60-2.00	0.14-0.19	Low	0.0-0.5	0.37	0.37		
187:											
Haug	0-10	---	0.13-0.42	0.60-6.00	0.35-0.48	---	50-90	---	---	5	2
	10-18	10-18	1.20-1.60	0.60-6.00	0.12-0.24	Low	4.0-6.0	0.20	0.20		
	18-60	10-18	1.40-1.60	0.60-2.00	0.11-0.19	Low	0.5-1.0	0.20	0.20		
205:											
Karlstad	0-12	1-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	1.0-4.0	0.17	0.17	3	2
	12-16	5-18	1.35-1.60	2.00-6.00	0.13-0.18	Low	0.5-2.0	0.24	0.24		
	16-19	5-18	1.50-1.70	2.00-6.00	0.12-0.16	Low	0.0-0.5	0.10	0.17		
	19-60	1-5	1.50-1.70	6.00-20.00	0.02-0.04	Low	0.0-0.5	0.10	0.17		
236:											
Vallers	0-9	18-27	1.20-1.35	0.60-2.00	0.22-0.24	Low	5.0-8.0	0.28	0.28	5	4L
	9-15	18-35	1.40-1.55	0.20-0.60	0.15-0.19	Moderate	1.0-3.0	0.28	0.28		
	15-60	18-35	1.50-1.70	0.20-0.60	0.17-0.19	Low	0.0-0.5	0.37	0.37		
242B:											
Marquette	0-7	1-10	1.40-1.60	6.00-20.00	0.10-0.14	Low	1.0-3.0	0.17	0.17	5	2
	7-13	5-18	1.50-1.70	2.00-6.00	0.10-0.16	Low	0.5-1.0	0.20	0.20		
	13-60	1-5	1.50-1.70	>20.00	0.02-0.04	Low	0.0-0.5	0.10	0.10		
258B:											
Sandberg	0-12	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.15	0.15	5	2
	12-60	0-5	1.50-1.65	>20.00	0.02-0.06	Low	0.0-0.5	0.05	0.10		
280:											
Pelan	0-6	5-20	1.35-1.55	2.00-6.00	0.10-0.13	Low	0.5-3.0	0.24	0.24	5	3
	6-12	15-25	1.50-1.65	6.00-20.00	0.05-0.11	Low	0.5-1.0	0.20	0.24		
	12-24	1-8	1.55-1.70	6.00-20.00	0.02-0.09	Low	0.0-0.5	0.20	0.20		
	24-60	8-18	1.40-1.75	0.60-2.00	0.14-0.18	Low	0.0-0.5	0.28	0.28		

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group
								K	Kf	T	
	In	Pct	g/cc	In/hr	In/in		Pct				
372:											
Hamar-----------	0-7	5-10	1.20-1.30	2.00-20.00	0.10-0.12	Low------	1.0-3.0	0.17	0.17	5	2
	7-20	0-7	1.35-1.55	2.00-20.00	0.10-0.12	Low------	0.0-2.0	0.17	0.17		
	20-60	0-7	1.45-1.65	2.00-20.00	0.06-0.08	Low------	0.0-0.5	0.17	0.17		
379:											
Percy-----------	0-8	10-30	1.30-1.60	0.60-2.00	0.18-0.22	Moderate	4.0-9.0	0.24	0.28	5	4L
	8-13	5-15	1.50-1.65	2.00-6.00	0.12-0.15	Low------	1.0-2.0	0.10	0.20		
	13-20	10-18	1.30-1.60	0.60-2.00	0.15-0.19	Low------	0.5-7.0	0.24	0.28		
	20-60	7-18	1.40-1.60	0.60-2.00	0.12-0.19	Low------	0.0-0.5	0.24	0.28		
383:											
Percy-----------	0-8	10-30	1.30-1.60	0.60-2.00	0.18-0.22	Moderate	4.0-9.0	0.24	0.28	5	4L
	8-11	5-15	1.50-1.65	2.00-6.00	0.12-0.15	Low------	1.0-2.0	0.10	0.20		
	11-35	10-18	1.30-1.60	0.60-2.00	0.15-0.19	Low------	0.5-7.0	0.24	0.28		
	35-60	7-18	1.40-1.60	0.60-2.00	0.12-0.19	Low------	0.0-0.5	0.24	0.28		
384:											
Percy-----------	0-4	10-18	1.30-1.60	0.60-2.00	0.20-0.22	Moderate	4.0-12	0.24	0.28	5	4L
	4-18	20-35	1.30-1.60	0.60-2.00	0.15-0.19	Moderate	0.0-1.0	0.24	0.28		
	18-60	7-18	1.40-1.60	0.60-2.00	0.12-0.19	Low------	0.0-0.5	0.24	0.28		
387:											
Roliss----------	0-9	18-27	1.10-1.50	0.20-2.00	0.17-0.24	Moderate	3.0-8.0	0.28	0.28	5	6
	9-17	18-35	1.30-1.70	0.20-0.60	0.15-0.19	Moderate	1.0-3.0	0.28	0.28		
	17-60	18-35	1.30-1.70	0.20-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28		
412:											
Mavie-----------	0-10	8-18	1.35-1.55	2.00-6.00	0.13-0.15	Low------	3.0-6.0	0.20	0.20	3	3
	10-16	10-27	1.35-1.55	0.60-2.00	0.12-0.19	Low------	1.0-3.0	0.28	0.28		
	16-27	2-10	1.40-1.65	6.00-20.00	0.03-0.05	Low------	0.0-0.5	0.10	0.15		
	27-60	18-35	1.40-1.70	0.20-2.00	0.15-0.21	Low------	0.0-0.5	0.37	0.37		
418:											
Lamoure---------	0-21	27-34	1.15-1.25	0.20-2.00	0.19-0.22	Moderate	4.0-8.0	0.28	0.28	5	4L
	21-42	20-34	1.20-1.35	0.20-2.00	0.17-0.20	Moderate	1.0-3.0	0.32	0.32		
	42-60	20-34	1.25-1.40	0.20-2.00	0.09-0.18	Moderate	0.0-0.5	0.28	0.28		
426:											
Foldahl---------	0-13	4-9	1.40-1.55	6.00-20.00	0.10-0.14	Low------	1.0-4.0	0.20	0.20	5	2
	13-33	2-10	1.45-1.60	6.00-20.00	0.07-0.12	Low------	0.5-1.0	0.20	0.20		
	33-60	18-35	1.50-1.65	0.20-2.00	0.14-0.19	Moderate	0.0-0.5	0.37	0.37		
429A:											
Northcote-------	0-10	55-75	1.00-1.20	0.06-0.20	0.13-0.16	High-----	3.0-6.0	0.28	0.28	5	4
	10-29	60-85	1.15-1.45	0.06-0.20	0.10-0.14	High-----	1.0-3.0	0.28	0.28		
	29-60	60-85	1.15-1.45	0.06-0.20	0.10-0.14	High-----	0.5-1.0	0.28	0.28		
432:											
Strandquist-----	0-10	10-25	1.20-1.70	0.60-2.00	0.14-0.18	Moderate	2.0-6.0	0.28	0.32	3	4L
	10-30	1-8	1.50-1.70	6.00-20.00	0.03-0.05	Low------	1.0-3.0	0.10	0.15		
	30-60	15-30	1.30-1.65	0.60-2.00	0.12-0.19	Moderate	0.0-0.5	0.37	0.37		
435:											
Syrene----------	0-10	8-18	1.25-1.45	2.00-6.00	0.13-0.18	Low------	3.0-8.0	0.20	0.20	3	3
	10-19	10-30	1.30-1.50	2.00-6.00	0.15-0.19	Low------	---	0.37	0.37		
	19-60	2-10	1.50-1.70	6.00-20.00	0.02-0.04	Low------	---	0.10	0.10		
439:											
Strathcona------	0-9	12-18	1.25-1.45	2.00-6.00	0.14-0.17	Low------	3.0-6.0	0.20	0.20	3	3
	9-15	10-18	1.30-1.50	2.00-6.00	0.14-0.16	Low------	0.5-1.0	0.24	0.24		
	15-32	2-8	1.35-1.60	6.00-20.00	0.05-0.09	Low------	0.0-0.5	0.10	0.10		
	32-60	15-30	1.40-1.60	0.20-2.00	0.14-0.18	Moderate	0.0-0.5	0.32	0.32		

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodi-bility group
								K	Kf	T	
	In	Pct	g/cc	In/hr	In/in		Pct				
481:											
Kratka----------	0-9	5-15	1.20-1.50	2.00-6.00	0.13-0.18	Low------	2.0-5.0	0.20	0.20	3	3
	9-26	2-10	1.30-1.60	6.00-20.00	0.06-0.11	Low------	0.5-1.0	0.17	0.17		
	26-60	10-35	1.50-1.80	0.20-2.00	0.11-0.19	Moderate	0.0-0.5	0.32	0.32		
482:											
Grygla----------	0-7	2-15	1.40-1.60	6.00-20.00	0.13-0.15	Low------	1.0-4.0	0.15	0.15	5	2
	7-33	1-10	1.50-1.70	6.00-20.00	0.06-0.11	Low------	0.5-1.0	0.15	0.15		
	33-60	8-27	1.30-1.75	0.20-2.00	0.17-0.19	Moderate	0.0-0.5	0.37	0.37		
514:											
Tacoosh---------	0-29	---	0.10-0.30	0.20-6.00	0.35-0.45	---------	75-99	---	---	2	2
	29-36	---	0.10-0.20	0.60-6.00	0.45-0.55	---------	75-99	---	---		
	36-60	5-35	1.40-2.00	0.20-2.00	0.12-0.20	Low------	0.0-0.5	0.32	0.37		
540:											
Seelyeville-----	0-8	---	0.10-0.25	0.20-6.00	0.35-0.45	---------	25-99	---	---	3	2
	8-60	---	0.10-0.25	0.20-6.00	0.35-0.45	---------	25-99	---	---		
541:											
Rifle-----------	0-6	---	0.20-0.35	0.60-6.00	0.48-0.58	---------	75-99	---	---	5	5
	6-60	---	0.08-0.20	0.60-6.00	0.48-0.58	---------	25-99	---	---		
543:											
Markey----------	0-25	---	0.15-0.45	0.20-6.00	0.35-0.45	---------	55-85	---	---	4	2
	25-60	0-10	1.40-1.65	6.00-20.00	0.03-0.08	Low------	0.0-0.5	0.15	0.15		
544:											
Cathro----------	0-11	---	0.28-0.45	0.20-6.00	0.45-0.55	---------	60-85	---	---	5	2
	11-25	---	0.15-0.30	0.20-6.00	0.35-0.45	---------	60-85	---	---		
	25-60	10-30	1.50-1.70	0.20-2.00	0.11-0.22	Low------	1.0-5.0	0.20	0.24		
546:											
Lupton----------	0-12	---	0.10-0.35	0.20-6.00	0.35-0.45	---------	70-90	---	---	5	2
	12-60	---	0.10-0.35	0.20-6.00	0.35-0.45	---------	---	---	---		
547:											
Deerwood--------	0-11	---	0.10-0.30	0.60-6.00	0.35-0.45	---------	50-90	---	---	5	2
	11-15	2-18	1.20-1.70	2.00-20.00	0.09-0.17	Low------	4.0-10	0.17	0.17		
	15-60	0-10	1.50-1.70	6.00-20.00	0.02-0.07	Low------	0.5-2.0	0.17	0.17		
550:											
Dora------------	0-23	---	0.13-0.42	0.60-6.00	0.35-0.55	---------	21-90	---	---	2	2
	23-31	35-60	0.13-0.42	0.60-6.00	0.35-0.55	---------	21-90	---	---		
	31-60	35-60	1.40-1.65	0.00-0.06	0.10-0.20	High-----	0.0-0.5	0.32	0.32		
563:											
Northwood-------	0-12	---	0.18-0.25	2.00-6.00	0.35-0.45	---------	50-85	---	---	5	2
	12-20	3-18	1.45-1.65	2.00-20.00	0.09-0.17	Low------	0.5-2.0	0.15	0.15		
	20-34	1-10	1.55-1.70	6.00-20.00	0.06-0.11	Low------	0.0-0.5	0.15	0.15		
	34-60	7-30	1.40-1.75	0.60-2.00	0.14-0.19	Moderate	0.0-0.5	0.37	0.37		
565:											
Eckvoll---------	0-8	5-15	1.30-1.70	6.00-20.00	0.10-0.12	Low------	1.0-3.0	0.17	0.17	5	2
	8-28	2-10	1.30-1.70	6.00-20.00	0.06-0.08	Low------	0.5-1.0	0.15	0.15		
	28-33	18-35	1.40-1.70	0.20-2.00	0.16-0.18	Moderate	0.0-0.5	0.37	0.37		
	33-60	16-32	1.30-1.70	0.20-2.00	0.17-0.19	Moderate	0.0-0.5	0.37	0.37		
582:											
Roliss----------	0-12	18-27	1.10-1.50	0.60-2.00	0.17-0.24	Moderate	3.0-7.0	0.28	0.28	5	4L
	12-17	18-35	1.30-1.70	0.20-2.00	0.15-0.19	Moderate	1.0-3.0	0.28	0.28		
	17-60	18-35	1.30-1.70	0.20-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28		

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors			Wind erodi- bility group
								K	Kf	T	
	In	Pct	g/cc	In/hr	In/in		Pct				
583:											
Nereson----------	0-10	7-12	1.35-1.45	2.00-6.00	0.14-0.17	Low-------	4.0-6.0	0.17	0.20	5	3
	10-18	10-18	1.35-1.45	0.60-2.00	0.18-0.22	Low-------	0.5-1.0	0.24	0.28		
	18-20	5-15	1.50-1.65	2.00-6.00	0.12-0.15	Low-------	0.5-1.0	0.10	0.20		
	20-33	7-18	1.50-1.65	0.60-6.00	0.16-0.18	Low-------	0.0-0.5	0.24	0.28		
	33-60	7-18	1.50-1.65	0.60-6.00	0.16-0.18	Low-------	0.0-0.5	0.24	0.28		
630:											
Wildwood---------	0-9	---	0.10-0.25	0.20-6.00	0.35-0.45	----------	25-99	---	---	5	2
	9-18	60-75	1.35-1.45	0.06-0.20	0.00-0.04	High------	0.0-0.5	0.28	0.28		
	18-60	50-75	1.40-1.55	0.00-0.20	0.00-0.04	High------	0.0-0.5	0.28	0.28		
641:											
Clearwater-------	0-10	40-60	1.20-1.50	0.06-0.20	0.13-0.17	High------	3.0-6.0	0.28	0.28	5	4
	10-20	35-60	1.20-1.50	0.06-0.20	0.15-0.18	High------	1.0-3.0	0.32	0.32		
	20-60	35-60	1.20-1.60	0.06-0.20	0.15-0.18	High------	0.0-0.5	0.32	0.32		
642:											
Clearwater-------	0-8	10-27	1.30-1.60	0.60-6.00	0.10-0.16	Low-------	2.0-5.0	0.24	0.24	5	5
	8-20	35-60	1.20-1.50	0.06-0.20	0.15-0.18	High------	1.0-3.0	0.32	0.32		
	20-60	35-60	1.20-1.60	0.06-0.20	0.15-0.18	High------	0.0-0.5	0.32	0.32		
643:											
Huot-------------	0-9	5-15	1.50-1.60	2.00-6.00	0.13-0.18	Low-------	2.0-4.0	0.20	0.20	5	3
	9-16	8-15	1.55-1.65	2.00-6.00	0.09-0.17	Low-------	0.5-1.0	0.20	0.20		
	16-29	3-8	1.55-1.70	6.00-20.00	0.06-0.11	Low-------	0.0-0.5	0.20	0.20		
	29-60	35-80	1.35-1.60	0.06-0.20	0.09-0.16	High------	0.0-0.5	0.32	0.32		
644:											
Boash------------	0-7	30-40	1.10-1.40	0.06-0.20	0.13-0.17	High------	3.0-6.0	0.32	0.32	5	4
	7-33	35-60	1.10-1.40	0.06-0.20	0.15-0.20	High------	1.0-3.0	0.32	0.32		
	33-60	16-35	1.20-1.60	0.60-2.00	0.12-0.18	Low-------	0.0-0.5	0.32	0.32		
645:											
Espelie----------	0-10	8-18	1.30-1.45	2.00-6.00	0.13-0.18	Low-------	2.0-4.0	0.20	0.20	5	3
	10-34	3-10	1.35-1.60	2.00-20.00	0.06-0.11	Low-------	0.5-1.0	0.17	0.17		
	34-60	35-60	1.35-1.60	0.06-0.20	0.09-0.19	High------	0.0-0.5	0.32	0.32		
647:											
Hilaire----------	0-11	6-15	1.25-1.45	6.00-20.00	0.10-0.14	Low-------	1.0-3.0	0.15	0.15	5	2
	11-22	3-10	1.25-1.40	6.00-20.00	0.07-0.14	Low-------	1.0-2.0	0.15	0.15		
	22-34	1-10	1.20-1.40	6.00-20.00	0.07-0.12	Low-------	0.0-0.5	0.10	0.17		
	34-60	35-60	1.35-1.55	0.06-0.20	0.09-0.19	High------	0.0-0.5	0.32	0.32		
648:											
Newfolden--------	0-7	10-27	1.35-1.45	0.60-2.00	0.20-0.22	Low-------	3.0-6.0	0.28	0.28	5	5
	7-16	35-55	1.40-1.50	0.06-0.20	0.13-0.19	High------	0.5-1.0	0.32	0.32		
	16-36	16-30	1.40-1.65	0.60-2.00	0.15-0.19	Low-------	0.0-0.5	0.28	0.32		
	36-60	16-30	1.40-1.65	0.60-2.00	0.16-0.19	Low-------	0.0-0.5	0.28	0.32		
649:											
Reiner-----------	0-10	4-12	1.30-1.70	6.00-20.00	0.10-0.12	Low-------	3.0-5.0	0.17	0.17	5	2
	10-16	24-35	1.40-1.75	0.60-2.00	0.15-0.19	Moderate	---	0.32	0.32		
	16-60	18-30	1.35-1.75	0.60-2.00	0.14-0.19	Low-------	---	0.32	0.32		
650:											
Reiner-----------	0-9	4-15	1.20-1.70	2.00-6.00	0.16-0.18	Low-------	4.0-6.0	0.20	0.24	5	3
	9-16	24-35	1.40-1.75	0.60-2.00	0.15-0.19	Moderate	---	0.32	0.32		
	16-60	18-30	1.35-1.75	0.60-2.00	0.14-0.19	Low-------	---	0.32	0.32		

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group
								K	Kf	T	
	In	Pct	g/cc	In/hr	In/in		Pct				
651:											
Thiefriver	0-8	8-18	1.30-1.45	2.00-6.00	0.13-0.18	Low	2.0-4.0	0.24	0.24	5	3
	8-15	8-18	1.25-1.40	2.00-20.00	0.09-0.17	Low	0.0-1.0	0.28	0.28		
	15-31	2-10	1.25-1.40	6.00-20.00	0.06-0.11	Low	0.0-0.5	0.17	0.17		
	31-60	35-70	1.35-1.60	0.06-0.20	0.09-0.19	High	0.0-0.5	0.32	0.32		
652:											
Wyandotte	0-8	27-30	1.30-1.45	0.60-2.00	0.14-0.20	Low	4.0-8.0	0.32	0.32	3	4L
	8-15	18-24	1.30-1.45	0.60-2.00	0.14-0.18	Low	---	0.32	0.32		
	15-29	2-10	1.40-1.70	6.00-20.00	0.02-0.04	Low	---	0.10	0.15		
	29-60	35-80	1.40-1.55	0.06-0.20	0.08-0.12	High	---	0.32	0.32		
653:											
Smiley	0-2	8-27	1.20-1.50	0.20-2.00	0.20-0.24	Moderate	15-35	0.24	0.24	5	5
	2-8	6-18	1.30-1.70	0.20-2.00	0.13-0.18	Moderate	5.0-20	0.24	0.24		
	8-21	18-35	1.35-1.60	0.20-2.00	0.15-0.19	Moderate	0.5-5.0	0.24	0.24		
	21-60	16-32	1.40-1.70	0.20-2.00	0.14-0.19	Moderate	0.0-0.5	0.24	0.24		
708:											
Rushlake	0-8	3-10	1.50-1.70	6.00-20.00	0.10-0.12	Low	0.5-4.0	0.17	0.17	5	2
	8-60	1-10	1.50-1.70	6.00-20.00	0.02-0.10	Low	0.0-0.5	0.05	0.10		
712:											
Rosewood	0-12	8-18	1.20-1.40	2.00-6.00	0.13-0.18	Low	4.0-7.0	0.24	0.24	3	3
	12-22	6-18	1.20-1.40	2.00-6.00	0.11-0.15	Low	1.0-3.0	0.24	0.24		
	22-60	1-6	1.45-1.65	6.00-20.00	0.05-0.08	Low	0.0-0.5	0.24	0.24		
713:											
Linveldt	0-13	8-15	1.20-1.40	2.00-6.00	0.13-0.18	Low	2.0-4.0	0.28	0.28	5	3
	13-19	12-18	1.25-1.50	0.60-6.00	0.12-0.18	Low	1.0-3.0	0.28	0.28		
	19-31	2-10	1.45-1.70	6.00-20.00	0.06-0.11	Low	0.0-0.5	0.17	0.17		
	31-60	16-30	1.35-1.70	0.60-2.00	0.14-0.19	Low	0.0-0.5	0.32	0.32		
721B:											
Corliss	0-7	2-10	1.40-1.60	6.00-20.00	0.10-0.12	Low	1.0-3.0	0.15	0.15	5	2
	7-12	0-10	1.50-1.65	6.00-20.00	0.03-0.10	Low	0.0-0.5	0.10	0.15		
	12-60	0-5	1.50-1.65	6.00-20.00	0.02-0.06	Low	0.0-0.5	0.10	0.15		
765:											
Smiley	0-9	8-20	1.20-1.50	0.60-2.00	0.20-0.24	Low	2.0-5.0	0.24	0.24	5	5
	9-16	18-35	1.35-1.60	0.60-2.00	0.15-0.19	Moderate	0.5-2.0	0.24	0.24		
	16-60	16-32	1.40-1.70	0.60-2.00	0.14-0.19	Low	0.0-0.5	0.24	0.24		
794:											
Clearriver	0-9	5-15	1.40-1.60	6.00-20.00	0.10-0.12	Low	1.0-2.0	0.17	0.17	5	2
	9-14	3-10	1.55-1.70	6.00-20.00	0.06-0.11	Low	0.0-0.5	0.15	0.15		
	14-60	1-5	1.55-1.70	6.00-20.00	0.02-0.06	Low	0.0-0.5	0.10	0.15		
935:											
Hegne	0-8	40-60	1.20-1.35	0.06-0.20	0.14-0.17	High	3.0-7.0	0.32	0.32	5	4L
	8-23	40-60	1.25-1.40	0.06-0.20	0.13-0.16	High	1.0-3.0	0.32	0.32		
	23-60	40-60	1.25-1.40	0.06-0.20	0.09-0.16	High	0.0-0.5	0.32	0.32		
Fargo	0-15	40-60	1.10-1.30	0.06-0.20	0.15-0.18	High	4.0-10	0.32	0.32	5	4
	15-31	40-60	1.20-1.50	0.06-0.20	0.14-0.17	High	---	0.32	0.32		
	31-60	40-60	1.20-1.50	0.06-0.20	0.14-0.17	High	---	0.32	0.32		
936:											
Clearwater	0-9	10-27	1.30-1.60	0.60-6.00	0.10-0.16	Low	2.0-5.0	0.24	0.24	5	5
	9-30	35-60	1.20-1.50	0.06-0.20	0.15-0.18	High	1.0-3.0	0.32	0.32		
	30-60	35-60	1.20-1.60	0.06-0.20	0.15-0.18	High	0.0-0.5	0.32	0.32		

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group
								K	Kf	T	
	In	Pct	g/cc	In/hr	In/in		Pct				
936:											
Reis	0-7	28-40	1.25-1.50	0.20-0.60	0.17-0.22	Moderate	4.0-8.0	0.28	0.28	5	4L
	7-21	40-70	1.20-1.50	0.06-0.20	0.13-0.16	High	1.0-2.0	0.24	0.24		
	21-60	40-70	1.40-1.70	0.06-0.20	0.08-0.14	High	0.0-0.5	0.28	0.28		
937:											
Eaglepoint	0-10	60-80	1.15-1.40	0.06-0.20	0.13-0.16	High	4.0-8.0	0.28	0.28	5	4L
	10-29	60-80	1.20-1.45	0.06-0.20	0.10-0.14	High	0.5-1.0	0.28	0.28		
	29-48	60-80	1.35-1.45	0.00-0.06	0.09-0.13	High	0.0-0.5	0.28	0.28		
	48-60	55-75	1.35-1.45	0.00-0.06	0.09-0.13	High	0.0-0.5	0.28	0.28		
Northcote	0-13	55-75	1.00-1.20	0.06-0.20	0.13-0.16	High	3.0-6.0	0.28	0.28	5	4
	13-23	60-85	1.15-1.45	0.06-0.20	0.10-0.14	High	1.0-3.0	0.28	0.28		
	23-60	60-85	1.15-1.45	0.06-0.20	0.10-0.14	High	0.5-1.0	0.28	0.28		
972:											
Roliss	0-9	18-27	1.10-1.50	0.60-2.00	0.17-0.24	Moderate	3.0-7.0	0.28	0.28	5	4L
	9-17	18-35	1.30-1.70	0.20-2.00	0.15-0.19	Moderate	1.0-3.0	0.28	0.28		
	17-60	18-35	1.30-1.70	0.20-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28		
Vallers	0-9	18-27	1.20-1.35	0.60-2.00	0.22-0.24	Low	5.0-8.0	0.28	0.28	5	4L
	9-15	18-35	1.40-1.55	0.20-0.60	0.15-0.19	Moderate	1.0-3.0	0.28	0.28		
	15-60	18-35	1.50-1.70	0.20-0.60	0.17-0.19	Low	0.0-0.5	0.37	0.37		
1006:											
Fluvaquents	0-4	6-18	1.20-1.40	0.60-2.00	0.18-0.24	Low	3.0-10	0.28	0.28	5	5
	4-60	10-27	1.30-1.60	0.60-2.00	0.12-0.22	Moderate	0.5-2.0	0.24	0.24		
Haploborolls	0-11	20-35	1.24-1.32	0.60-2.00	0.17-0.22	Moderate	1.0-3.0	0.28	0.28	5	6
	11-60	15-30	1.24-1.32	0.60-2.00	0.14-0.20	Low	0.0-0.5	0.28	0.28		
1030:											
Pits.											
Udipsamments	0-14	1-15	1.50-1.70	2.00-20.00	0.05-0.10	Low	0.0-0.5	0.15	0.15	5	2
	14-60	1-10	1.50-1.70	6.00-20.00	0.05-0.08	Low	---	0.10	0.10		
1031:											
Seelyeville	0-14	---	0.10-0.25	0.20-6.00	0.35-0.45	---------	25-99	---	---	3	8
	14-60	---	0.10-0.25	0.20-6.00	0.35-0.45	---------	25-99	---	---		
1143:											
Berner	0-33	---	0.15-0.40	0.20-6.00	0.35-0.48	---------	80-95	---	---	2	2
	33-44	0-5	1.50-1.75	6.00-20.00	0.05-0.10	Low	0.0-0.5	0.05	0.15		
	44-60	18-30	1.45-1.65	0.20-2.00	0.14-0.22	Moderate	0.0-0.5	0.32	0.37		
Markey	0-29	---	0.15-0.45	0.20-6.00	0.35-0.45	---------	55-85	---	---	4	2
	29-60	0-10	1.40-1.65	6.00-20.00	0.03-0.08	Low	0.0-0.5	0.15	0.15		
1144:											
Strathcona	0-10	12-18	1.20-1.40	0.60-2.00	0.20-0.30	Low	10-20	0.20	0.20	3	3
	10-16	10-18	1.30-1.50	2.00-6.00	0.14-0.16	Low	0.5-2.0	0.24	0.24		
	16-30	2-8	1.35-1.60	6.00-20.00	0.05-0.09	Low	0.0-0.5	0.10	0.10		
	30-60	15-30	1.40-1.60	0.20-2.00	0.14-0.18	Moderate	0.0-0.5	0.32	0.32		
Kratka	0-9	5-15	1.20-1.50	2.00-20.00	0.14-0.18	Low	5.0-25	0.20	0.20	5	3
	9-26	2-10	1.30-1.60	6.00-20.00	0.06-0.11	Low	0.5-1.0	0.17	0.17		
	26-80	10-35	1.50-1.80	0.20-2.00	0.11-0.19	Moderate	0.0-0.5	0.32	0.32		

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodi-bility group
								K	Kf	T	
	In	Pct	g/cc	In/hr	In/in		Pct				
1146:											
Northwood-------	0-15	---	0.18-0.25	2.00-6.00	0.35-0.45	---------	50-85	---	---	5	8
	15-21	3-18	1.45-1.65	2.00-20.00	0.09-0.17	Low------	0.5-2.0	0.10	0.15		
	21-28	1-10	1.55-1.70	6.00-20.00	0.06-0.11	Low------	0.0-0.5	0.10	0.15		
	28-60	7-30	1.40-1.75	0.60-2.00	0.14-0.19	Moderate	0.0-0.5	0.32	0.37		
1158:											
Skagen----------	0-7	10-18	1.25-1.40	0.60-2.00	0.16-0.18	Low------	4.0-9.0	0.20	0.24	5	4L
	7-10	10-18	1.30-1.50	0.60-6.00	0.07-0.15	Low------	1.0-3.0	0.10	0.20		
	10-21	10-18	1.30-1.50	0.60-6.00	0.11-0.18	Low------	0.5-2.0	0.24	0.28		
	21-60	10-18	1.30-1.50	0.60-6.00	0.11-0.18	Low------	0.0-0.5	0.24	0.28		
1170:											
Skagen----------	0-10	10-18	1.25-1.40	0.60-2.00	0.16-0.18	Low------	4.0-9.0	0.20	0.24	5	4L
	10-13	10-18	1.30-1.50	0.60-6.00	0.07-0.15	Low------	1.0-3.0	0.10	0.20		
	13-19	10-18	1.30-1.50	0.60-6.00	0.11-0.18	Low------	0.5-2.0	0.24	0.28		
	19-60	10-18	1.30-1.50	0.60-6.00	0.11-0.18	Low------	0.0-0.5	0.24	0.28		
1187:											
Dora------------	0-31	---	0.15-0.45	0.60-6.00	0.35-0.55	---------	25-99	---	---	2	8
	31-42	22-40	1.10-1.25	0.60-2.00	0.22-0.25	Moderate	10-20	0.28	0.28		
	42-60	35-60	1.40-1.65	0.00-0.06	0.00-0.04	High-----	0.0-0.5	0.28	0.28		
1188:											
Wildwood--------	0-14	---	0.10-0.25	0.20-6.00	0.35-0.45	---------	25-99	---	---	5	8
	14-23	60-75	1.35-1.45	0.06-0.20	0.00-0.04	High-----	0.0-0.5	0.28	0.28		
	23-60	50-75	1.40-1.55	0.00-0.20	0.00-0.04	High-----	0.0-0.5	0.28	0.28		
1189:											
Clearwater------	0-7	18-27	1.20-1.40	0.20-6.00	0.22-0.30	Low------	10-20	0.28	0.28	5	6
	7-10	25-60	1.30-1.60	0.06-2.00	0.13-0.22	Moderate	3.0-6.0	0.24	0.32		
	10-60	35-60	1.20-1.50	0.06-0.20	0.10-0.19	High-----	1.0-3.0	0.32	0.32		
1191:											
Sahkahtay-------	0-4	5-15	1.35-1.50	2.00-6.00	0.10-0.14	Low------	2.0-4.0	0.20	0.20	5	3
	4-8	2-10	1.45-1.55	6.00-20.00	0.05-0.08	Low------	0.5-1.0	0.15	0.15		
	8-14	18-30	1.40-1.55	0.60-2.00	0.13-0.17	Moderate	0.5-1.0	0.28	0.28		
	14-60	1-8	1.50-1.70	20.00-40.00	0.03-0.06	Low------	0.0-0.5	0.10	0.15		
1264:											
Ulen------------	0-10	5-12	1.35-1.60	6.00-20.00	0.10-0.13	Low------	1.0-3.0	0.17	0.17	5	2
	10-21	5-12	1.45-1.65	6.00-20.00	0.06-0.10	Low------	0.5-1.0	0.17	0.17		
	21-60	1-7	1.50-1.70	6.00-20.00	0.06-0.08	Low------	0.0-0.5	0.15	0.15		
1297:											
Augsburg--------	0-9	10-20	1.20-1.40	2.00-6.00	0.20-0.23	Low------	4.0-6.0	0.28	0.28	5	3
	9-29	5-18	1.40-1.60	2.00-6.00	0.17-0.22	Low------	0.5-1.0	0.28	0.28		
	29-60	35-85	1.10-1.40	0.00-0.20	0.10-0.14	High-----	0.0-0.5	0.28	0.28		
1299:											
Borup-----------	0-8	10-20	1.30-1.50	2.00-6.00	0.20-0.22	Low------	4.0-8.0	0.28	0.28	5	3
	8-21	10-18	1.30-1.50	2.00-6.00	0.17-0.20	Low------	1.0-3.0	0.32	0.32		
	21-60	5-18	1.35-1.65	2.00-20.00	0.15-0.19	Low------	0.0-0.5	0.24	0.24		
1304A:											
Glyndon---------	0-9	15-20	1.20-1.40	0.60-2.00	0.20-0.23	Low------	3.0-7.0	0.28	0.28	5	3
	9-60	5-18	1.35-1.65	2.00-6.00	0.15-0.19	Low------	0.0-0.5	0.43	0.43		
1304B:											
Glyndon---------	0-8	15-20	1.20-1.40	0.60-2.00	0.20-0.23	Low------	3.0-7.0	0.28	0.28	5	3
	8-17	10-18	1.30-1.50	0.60-6.00	0.17-0.20	Low------	1.0-2.0	0.43	0.43		
	17-60	5-18	1.35-1.65	2.00-6.00	0.15-0.19	Low------	0.0-0.5	0.43	0.43		

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group
								K	Kf	T	
	In	Pct	g/cc	In/hr	In/in		Pct				
1315A:											
Wheatville------	0-9	5-18	1.30-1.50	2.00-6.00	0.16-0.20	Low------	3.0-6.0	0.28	0.28	5	3
	9-29	5-18	1.35-1.55	2.00-6.00	0.15-0.21	Low------	---	0.28	0.28		
	29-60	35-80	1.15-1.50	0.06-0.20	0.10-0.14	High-----	---	0.28	0.28		
1804:											
Hamre-----------	0-9	---	0.18-0.22	0.20-2.00	0.35-0.48	Low------	85-95	---	---	5	8
	9-21	18-35	1.30-1.70	0.20-2.00	0.17-0.19	Moderate	4.0-10	0.32	0.32		
	21-60	18-35	1.40-1.70	0.20-2.00	0.17-0.19	Moderate	0.5-2.0	0.32	0.32		
1807:											
Cathro----------	0-20	---	0.28-0.45	0.20-6.00	0.45-0.55	---------	60-85	---	---	2	8
	20-36	---	0.15-0.30	0.20-6.00	0.35-0.45	---------	60-85	---	---		
	36-60	10-30	1.50-1.70	0.20-2.00	0.11-0.22	Low------	1.0-5.0	---	---		
1808:											
Markey----------	0-40	---	0.15-0.45	0.20-6.00	0.35-0.45	---------	55-85	---	---	4	8
	40-60	0-10	1.40-1.65	6.00-20.00	0.03-0.08	Low------	0.0-0.5	0.15	0.15		
1871:											
Fargo-----------	0-12	40-65	1.00-1.20	0.06-0.20	0.15-0.18	High-----	4.0-8.0	0.32	0.32	5	4
	12-37	40-65	1.15-1.50	0.06-0.20	0.14-0.17	High-----	---	0.32	0.32		
	37-60	40-65	1.15-1.50	0.06-0.20	0.14-0.17	High-----	---	0.32	0.32		
1874:											
Radium----------	0-14	1-8	1.55-1.75	6.00-20.00	0.06-0.12	Low------	1.0-3.0	0.17	0.17	5	2
	14-33	1-8	1.55-1.75	6.00-20.00	0.03-0.08	Low------	0.0-0.5	0.10	0.10		
	33-43	1-8	1.55-1.75	20.00-40.00	0.02-0.05	Low------	0.0-0.5	0.05	0.17		
	43-60	1-5	1.55-1.75	6.00-20.00	0.03-0.09	Low------	0.0-0.5	0.10	0.17		
1878:											
Hamre-----------	0-9	---	0.18-0.22	0.20-2.00	0.35-0.48	Low------	85-95	---	---	5	2
	9-14	18-35	1.30-1.70	0.20-2.00	0.17-0.19	Moderate	4.0-10	0.32	0.32		
	14-60	18-35	1.40-1.70	0.20-2.00	0.17-0.19	Moderate	0.5-2.0	0.32	0.32		
1882:											
Rosewood--------	0-8	8-18	1.20-1.40	2.00-6.00	0.13-0.18	Low------	4.0-7.0	0.24	0.24	3	3
	8-27	6-18	1.20-1.40	2.00-6.00	0.11-0.15	Low------	1.0-3.0	0.24	0.24		
	27-60	1-6	1.45-1.65	6.00-20.00	0.05-0.08	Low------	0.0-0.5	0.20	0.24		
Strathcona------	0-9	12-20	1.25-1.45	2.00-6.00	0.14-0.17	Low------	4.0-8.0	0.20	0.20	3	3
	9-21	2-8	1.35-1.60	6.00-20.00	0.05-0.09	Low------	0.0-0.5	0.10	0.10		
	21-60	15-30	1.40-1.60	0.20-2.00	0.14-0.18	Moderate	0.0-0.5	0.32	0.32		
Berner----------	0-21	---	0.15-0.40	0.20-6.00	0.35-0.48	---------	80-95	---	---	2	2
	21-35	0-5	1.50-1.75	6.00-20.00	0.05-0.10	Low------	0.0-0.5	0.05	0.15		
	35-60	18-30	1.45-1.65	0.20-2.00	0.14-0.22	Moderate	0.0-0.5	0.32	0.37		
1963:											
Bearden---------	0-10	27-39	1.20-1.40	0.20-0.60	0.17-0.23	Moderate	3.0-7.0	0.37	0.37	5	4L
	10-17	18-34	1.30-1.50	0.20-0.60	0.16-0.22	Moderate	1.0-4.0	0.37	0.37		
	17-60	18-34	1.30-1.80	0.20-0.60	0.16-0.22	Moderate	0.0-0.5	0.43	0.43		
Colvin----------	0-9	27-34	1.20-1.50	0.20-0.60	0.20-0.22	Moderate	4.0-7.0	0.32	0.32	5	4L
	9-21	18-34	1.20-1.50	0.20-0.60	0.16-0.20	Moderate	0.0-5.0	0.32	0.32		
	21-60	18-34	1.30-1.50	0.20-0.60	0.15-0.20	Moderate	0.0-1.0	0.32	0.32		
1964:											
Colvin----------	0-11	27-34	1.20-1.50	0.20-0.60	0.20-0.22	Moderate	4.0-7.0	0.32	0.32	5	4L
	11-19	18-34	1.20-1.50	0.20-0.60	0.16-0.20	Moderate	0.0-5.0	0.32	0.32		
	19-60	18-34	1.30-1.50	0.20-0.60	0.15-0.20	Moderate	0.0-1.0	0.32	0.32		

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group
								K	Kf	T	
	In	Pct	g/cc	In/hr	In/in		Pct				
1964:											
Fargo-----------	0-14	40-60	1.10-1.30	0.06-0.20	0.15-0.18	High-----	4.0-10	0.32	0.32	5	4
	14-26	40-60	1.20-1.50	0.06-0.20	0.14-0.17	High-----	---	0.32	0.32		
	26-60	40-60	1.20-1.50	0.06-0.20	0.14-0.17	High-----	---	0.32	0.32		
1966:											
Rosewood--------	0-11	8-18	1.20-1.40	2.00-6.00	0.13-0.18	Low------	4.0-7.0	0.24	0.24	3	3
	11-18	6-18	1.20-1.40	2.00-6.00	0.11-0.15	Low------	1.0-3.0	0.24	0.24		
	18-60	1-6	1.45-1.65	6.00-20.00	0.05-0.08	Low------	0.0-0.5	0.24	0.24		
Hamar-----------	0-16	5-10	1.20-1.30	2.00-20.00	0.10-0.12	Low------	1.0-3.0	0.17	0.17	5	2
	16-60	0-7	1.45-1.65	2.00-20.00	0.06-0.08	Low------	0.0-0.5	0.17	0.17		

Chemical Properties of the Soils

(Absence of an entry indicates that data were not available or were not estimated)

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
47:								
Colvin----------	0-9	27-34	25.0-40.0	6.6-8.4	0-10	0-1	---	0-2
	9-29	18-34	15.0-25.0	7.4-9.0	10-45	0-1	---	0-3
	29-60	18-34	10.0-20.0	7.4-8.4	5-20	0-5	---	0-10
57A:								
Fargo-----------	0-11	40-60	---	6.6-7.8	---	---	0-2	---
	11-17	40-60	---	6.6-8.4	---	---	0-2	---
	17-60	40-60	---	7.9-8.4	---	---	0-2	---
58:								
Kittson---------	0-11	10-27	12.0-26.0	6.6-7.8	---	---	---	---
	11-15	18-30	10.0-20.0	6.6-7.8	0-5	---	---	---
	15-60	18-30	10.0-16.0	7.4-8.4	10-30	---	---	---
59:								
Grimstad--------	0-10	10-18	10.0-18.0	7.4-8.4	5-15	---	---	---
	10-29	2-15	2.0-12.0	7.4-9.0	5-20	0-3	---	---
	29-60	10-30	4.0-16.0	7.4-9.0	15-35	0-3	---	---
65:								
Foxhome---------	0-8	10-20	10.0-24.0	6.6-7.8	---	---	---	---
	8-14	10-25	6.0-18.0	6.6-7.8	0-10	---	---	---
	14-26	5-15	2.0-10.0	7.4-8.4	5-15	---	---	---
	26-60	12-35	6.0-18.0	7.4-8.4	15-30	---	---	---
66:								
Flaming---------	0-15	2-10	4.0-13.0	5.6-7.3	---	---	---	---
	15-60	2-10	1.0-6.0	5.6-8.4	0-15	---	---	---
67A:								
Bearden---------	0-9	10-26	10.0-25.0	7.4-8.4	1-10	---	0-4	---
	9-16	18-34	10.0-25.0	7.4-8.4	10-20	0-2	0-4	0-1
	16-60	18-34	10.0-20.0	7.4-8.4	15-35	0-3	0-4	0-1
67B:								
Bearden---------	0-8	10-26	10.0-25.0	7.4-8.4	1-10	---	0-4	---
	8-14	18-34	10.0-25.0	7.4-8.4	10-20	0-2	0-4	0-1
	14-60	18-34	10.0-20.0	7.4-8.4	15-35	0-3	0-4	0-1
77:								
Garnes----------	0-10	5-20	3.0-14.0	6.1-7.8	---	---	---	---
	10-17	18-30	10.0-18.0	6.6-7.8	---	---	---	---
	17-60	10-27	5.0-14.0	7.4-8.4	10-40	---	---	---
93A:								
Bearden---------	0-11	27-39	15.0-30.0	7.4-8.4	1-10	---	0-4	---
	11-21	18-34	10.0-25.0	7.4-8.4	10-20	0-2	0-4	0-1
	21-60	18-34	10.0-20.0	7.4-8.4	15-35	0-3	0-4	0-1
111:								
Hangaard--------	0-8	8-18	10.0-26.0	6.6-7.8	---	---	---	---
	8-14	5-15	4.0-14.0	6.6-7.8	0-5	---	---	---
	14-60	2-10	2.0-6.0	7.4-8.4	5-15	---	---	---
116:								
Redby-----------	0-6	2-10	2.0-10.0	5.1-6.5	---	---	0-2	---
	6-36	1-8	1.0-5.0	5.1-6.5	---	---	0-2	---
	36-60	0-6	0.0-4.0	6.1-7.8	0-15	---	0-2	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
117:								
Cormant----------	0-8	3-10	5.0-26.0	6.1-7.3	---	---	---	---
	8-60	0-5	1.0-5.0	6.1-7.8	0-15	---	---	---
145:								
Enstrom----------	0-7	4-15	3.0-15.0	6.6-7.8	---	---	---	---
	7-25	1-12	1.0-8.0	6.6-8.4	0-10	---	---	---
	25-60	10-35	5.0-18.0	7.4-8.4	10-40	---	---	---
148:								
Poppleton--------	0-6	2-10	3.0-12.0	5.6-7.3	---	---	---	---
	6-60	1-10	1.0-6.0	6.1-7.8	0-15	---	---	---
157A:								
Wahpeton---------	0-35	40-59	---	6.1-7.8	---	---	---	---
	35-60	35-59	---	6.6-8.4	---	---	---	---
157B:								
Wahpeton---------	0-22	40-59	---	6.1-7.8	---	---	---	---
	22-60	35-59	---	6.6-8.4	---	---	---	---
184A:								
Hamerly----------	0-9	18-27	15.0-30.0	6.6-8.4	0-15	---	---	---
	9-16	18-30	8.0-20.0	7.4-8.4	15-30	---	---	---
	16-60	18-30	7.0-19.0	7.4-8.4	10-25	---	---	---
187:								
Haug-------------	0-10	---	100-180	6.6-7.8	0-5	---	---	---
	10-18	10-18	14.0-26.0	6.6-8.4	5-30	---	---	---
	18-60	10-18	10.0-16.0	7.4-8.4	5-30	---	---	---
205:								
Karlstad---------	0-12	1-10	2.0-15.0	4.5-7.3	---	---	---	---
	12-16	5-18	2.0-15.0	6.1-7.3	0-15	---	---	---
	16-19	5-18	1.0-15.0	6.1-7.8	0-15	---	---	---
	19-60	1-5	0.0-1.0	7.4-8.4	5-30	---	---	---
236:								
Vallers----------	0-9	18-27	20.0-32.0	7.4-8.4	12-25	---	0-4	---
	9-15	18-35	10.0-18.0	7.4-8.4	20-35	0-2	0-4	---
	15-60	18-35	8.0-16.0	7.4-8.4	12-25	0-2	0-4	---
242B:								
Marquette--------	0-7	1-10	2.0-12.0	5.6-7.3	---	---	---	---
	7-13	5-18	3.0-12.0	6.6-8.4	---	---	---	---
	13-60	1-5	1.0-4.0	7.4-8.4	5-20	---	---	---
258B:								
Sandberg---------	0-12	2-10	2.0-12.0	5.6-7.8	0-5	---	---	---
	12-60	0-5	1.0-4.0	7.4-8.4	5-10	---	---	---
280:								
Pelan------------	0-6	5-20	3.0-16.0	6.1-7.3	---	---	---	---
	6-12	15-25	7.0-15.0	6.1-7.8	---	---	---	---
	12-24	1-8	1.0-5.0	7.4-8.4	0-15	---	---	---
	24-60	8-18	4.0-10.0	7.4-8.4	15-40	---	---	---
372:								
Hamar------------	0-7	5-10	7.0-12.0	6.1-7.8	---	---	0-2	---
	7-20	0-7	3.0-9.0	6.6-8.4	0-1	---	0-2	---
	20-60	0-7	3.0-9.0	7.4-8.4	0-2	---	0-2	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
379:								
Percy-----------	0-8	10-30	12.0-36.0	6.6-8.4	0-20	---	---	---
	8-13	5-15	4.0-13.0	7.4-8.4	10-30	---	---	---
	13-20	10-18	5.0-13.0	7.4-8.4	25-45	---	---	---
	20-60	7-18	3.0-12.0	7.4-8.4	20-40	---	---	---
383:								
Percy-----------	0-8	10-30	12.0-36.0	6.6-8.4	0-20	---	---	---
	8-11	5-15	4.0-13.0	7.4-8.4	10-30	---	---	---
	11-35	10-18	5.0-13.0	7.4-8.4	25-45	---	---	---
	35-60	7-18	3.0-12.0	7.4-8.4	20-40	---	---	---
384:								
Percy-----------	0-4	10-18	12.0-36.0	6.6-8.4	0-20	---	---	---
	4-18	20-35	5.0-13.0	7.4-8.4	25-45	---	---	---
	18-60	7-18	3.0-12.0	7.4-8.4	20-40	---	---	---
387:								
Roliss----------	0-9	18-27	15.0-28.0	6.6-8.4	5-10	---	---	---
	9-17	18-35	10.0-18.0	7.4-8.4	5-15	0-3	---	---
	17-60	18-35	8.0-16.0	7.4-8.4	20-35	0-3	---	---
412:								
Mavie-----------	0-10	8-18	10.0-22.0	7.4-8.4	5-20	---	---	---
	10-16	10-27	6.0-20.0	7.9-8.4	15-40	---	---	---
	16-27	2-10	1.0-6.0	7.4-8.4	10-25	---	---	---
	27-60	18-35	9.0-18.0	7.4-8.4	10-30	0-3	---	---
418:								
Lamoure---------	0-21	27-34	25.0-32.0	7.4-8.4	0-10	---	0-4	1-2
	21-42	20-34	24.0-31.0	7.4-8.4	9-20	---	0-4	1-3
	42-60	20-34	16.0-23.0	7.4-8.4	4-20	0-2	0-4	1-3
426:								
Foldahl---------	0-13	4-9	4.0-14.0	6.1-7.8	---	---	---	---
	13-33	2-10	2.0-8.0	6.6-7.8	0-10	---	---	---
	33-60	18-35	6.0-18.0	7.4-8.4	10-25	---	---	---
429A:								
Northcote-------	0-10	55-75	32.0-50.0	6.6-7.3	---	---	0-4	---
	10-29	60-85	32.0-50.0	6.6-7.8	---	---	0-4	---
	29-60	60-85	30.0-45.0	7.4-8.4	2-15	0-3	0-4	---
432:								
Strandquist-----	0-10	10-25	8.0-25.0	6.6-8.4	0-10	---	---	---
	10-30	1-8	2.0-10.0	7.4-8.4	5-15	---	---	---
	30-60	15-30	7.0-16.0	7.4-8.4	20-40	---	---	---
435:								
Syrene----------	0-10	8-18	---	7.4-8.4	5-30	---	---	---
	10-19	10-30	---	7.9-8.4	15-35	---	---	---
	19-60	2-10	---	7.4-8.4	10-30	---	---	---
439:								
Strathcona------	0-9	12-18	10.0-25.0	7.4-8.4	5-15	---	---	---
	9-15	10-18	5.0-15.0	7.4-8.4	15-30	---	---	---
	15-32	2-8	2.0-8.0	7.4-8.4	5-15	---	---	---
	32-60	15-30	10.0-20.0	7.4-8.4	20-45	---	---	---
481:								
Kratka----------	0-9	5-15	6.0-20.0	5.6-7.8	0-15	---	---	---
	9-26	2-10	1.0-8.0	5.6-7.8	0-15	---	---	---
	26-60	10-35	4.0-21.0	6.1-8.4	0-30	---	---	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
482:								
Grygla	0-7	2-15	2.0-16.0	6.1-7.3	---	---	---	---
	7-33	1-10	1.0-8.0	6.6-7.8	---	---	---	---
	33-60	8-27	4.0-14.0	7.4-8.4	10-35	---	---	---
514:								
Tacoosh	0-29	---	150-200	5.6-7.8	---	---	---	---
	29-36	---	150-200	5.6-7.8	---	---	---	---
	36-60	5-35	3.0-20.0	5.6-8.4	0-30	---	---	---
540:								
Seelyeville	0-8	---	140-200	4.5-7.3	---	---	---	---
	8-60	---	140-200	4.5-7.3	---	---	---	---
541:								
Rifle	0-6	---	150-180	4.5-7.3	---	---	---	---
	6-60	---	50-150	4.5-7.3	---	---	---	---
543:								
Markey	0-25	---	110-170	4.5-7.8	0-5	---	---	---
	25-60	0-10	1.0-3.0	5.6-8.4	0-5	---	---	---
544:								
Cathro	0-11	---	120-170	4.5-7.8	---	---	---	---
	11-25	---	120-170	4.5-7.8	---	---	---	---
	25-60	10-30	2.0-25.0	6.6-8.4	5-25	---	---	---
546:								
Lupton	0-12	---	100-200	4.5-7.8	---	---	---	---
	12-60	---	100-200	4.5-7.8	---	---	---	---
547:								
Deerwood	0-11	---	90-190	5.6-7.8	0-5	---	---	---
	11-15	2-18	8.0-30.0	6.1-8.4	0-15	---	---	---
	15-60	0-10	1.0-10.0	7.4-8.4	10-20	---	---	---
550:								
Dora	0-23	---	40-180	4.5-7.8	---	---	---	---
	23-31	35-60	40-180	4.5-7.8	---	---	---	---
	31-60	35-60	18.0-31.0	6.1-8.4	0-20	---	---	---
563:								
Northwood	0-12	---	100-170	5.1-7.8	---	---	---	---
	12-20	3-18	2.0-20.0	5.6-7.8	---	---	---	---
	20-34	1-10	2.0-7.0	5.6-8.4	0-5	---	---	---
	34-60	7-30	4.0-18.0	7.4-8.4	5-15	---	---	---
565:								
Eckvoll	0-8	5-15	3.0-14.0	6.1-7.3	---	---	---	---
	8-28	2-10	1.0-7.0	6.1-7.3	---	---	---	---
	28-33	18-35	8.0-18.0	6.6-7.8	---	---	---	---
	33-60	16-32	6.0-16.0	7.4-8.4	10-30	---	---	---
582:								
Roliss	0-12	18-27	15.0-28.0	6.6-8.4	5-10	---	---	---
	12-17	18-35	10.0-18.0	7.4-8.4	5-15	0-3	---	---
	17-60	18-35	8.0-16.0	7.4-8.4	12-25	0-3	---	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
583:								
Nereson----------	0-10	7-12	10.0-14.0	6.1-7.3	---	---	---	---
	10-18	10-18	5.0-13.0	6.6-7.8	0-5	---	---	---
	18-20	5-15	3.0-11.0	7.4-8.4	10-30	---	---	---
	20-33	7-18	3.0-12.0	7.4-8.4	15-30	---	---	---
	33-60	7-18	3.0-12.0	7.4-8.4	10-30	---	---	---
630:								
Wildwood---------	0-9	---	140-200	5.1-6.5	---	---	---	---
	9-18	60-75	30.0-60.0	5.6-7.3	---	---	---	---
	18-60	50-75	30.0-60.0	7.4-8.4	5-30	---	---	---
641:								
Clearwater-------	0-10	40-60	26.0-42.0	6.6-7.8	---	---	---	---
	10-20	35-60	18.0-36.0	7.4-8.4	5-25	---	---	---
	20-60	35-60	18.0-30.0	7.4-8.4	5-25	---	---	---
642:								
Clearwater-------	0-8	10-27	8.0-24.0	6.6-7.8	---	---	---	---
	8-20	35-60	18.0-36.0	7.4-8.4	5-25	---	---	---
	20-60	35-60	18.0-30.0	7.4-8.4	5-25	---	---	---
643:								
Huot-------------	0-9	5-15	10.0-18.0	7.4-8.4	5-15	---	---	---
	9-16	8-15	10.0-18.0	7.4-8.4	15-35	---	---	---
	16-29	3-8	2.0-12.0	7.4-8.4	10-30	---	---	---
	29-60	35-80	10.0-20.0	7.4-8.4	5-15	---	---	---
644:								
Boash------------	0-7	30-40	20.0-32.0	6.6-7.8	0-10	---	---	---
	7-33	35-60	18.0-38.0	6.6-7.8	5-20	---	---	---
	33-60	16-35	8.0-18.0	7.4-8.4	10-30	---	---	---
645:								
Espelie----------	0-10	8-18	8.0-18.0	6.6-7.3	---	---	---	---
	10-34	3-10	2.0-8.0	6.6-7.8	0-15	---	---	---
	34-60	35-60	16.0-30.0	7.4-8.4	10-30	0-3	---	---
647:								
Hilaire----------	0-11	6-15	5.0-14.0	6.6-7.3	0-10	---	---	---
	11-22	3-10	3.0-10.0	6.6-7.8	0-10	---	---	---
	22-34	1-10	1.0-6.0	6.6-7.8	0-15	---	---	---
	34-60	35-60	16.0-30.0	7.4-8.4	10-30	---	---	---
648:								
Newfolden--------	0-7	10-27	10.0-38.0	6.6-7.8	---	---	---	---
	7-16	35-55	16.0-35.0	6.6-7.8	---	---	---	---
	16-36	16-30	6.0-19.0	7.4-8.4	15-35	---	---	---
	36-60	16-30	6.0-19.0	7.4-8.4	10-25	---	---	---
649:								
Reiner-----------	0-10	4-12	15.0-20.0	6.6-7.3	---	---	0-2	---
	10-16	24-35	30.0-40.0	6.6-7.3	0-10	---	0-2	---
	16-60	18-30	10.0-25.0	7.4-8.4	20-30	---	0-2	---
650:								
Reiner-----------	0-9	4-15	15.0-20.0	6.6-7.3	---	---	0-2	---
	9-16	24-35	30.0-40.0	6.6-7.3	0-10	---	0-2	---
	16-60	18-30	10.0-25.0	7.4-8.4	20-30	---	0-2	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
651:								
Thiefriver	0-8	8-18	8.0-17.0	7.4-8.4	5-15	---	---	---
	8-15	8-18	4.0-11.0	7.4-8.4	10-25	---	---	---
	15-31	2-10	1.0-6.0	7.4-8.4	5-10	---	---	---
	31-60	35-70	24.0-50.0	7.4-8.4	5-15	---	---	---
652:								
Wyandotte	0-8	27-30	---	7.4-7.8	---	---	---	---
	8-15	18-24	---	7.9-8.4	---	---	---	---
	15-29	2-10	---	7.4-8.4	---	---	---	---
	29-60	35-80	---	7.4-7.8	---	---	---	---
653:								
Smiley	0-2	8-27	30.0-90.0	6.6-7.8	0-15	---	---	---
	2-8	6-18	12.0-50.0	6.6-7.8	0-15	---	---	---
	8-21	18-35	8.0-30.0	6.6-8.4	0-30	---	---	---
	21-60	16-32	6.0-25.0	7.9-8.4	10-30	---	---	---
708:								
Rushlake	0-8	3-10	2.0-12.0	6.1-7.8	0-15	---	---	---
	8-60	1-10	1.0-6.0	7.4-8.4	5-30	---	---	---
712:								
Rosewood	0-12	8-18	8.0-24.0	7.4-8.4	5-20	---	---	---
	12-22	6-18	5.0-15.0	7.4-8.4	15-30	---	---	---
	22-60	1-6	1.0-4.0	7.4-8.4	5-25	---	---	---
713:								
Linveldt	0-13	8-15	8.0-16.0	6.6-7.8	---	---	---	---
	13-19	12-18	8.0-16.0	6.6-7.8	---	---	---	---
	19-31	2-10	2.0-6.0	7.4-8.4	0-15	---	---	---
	31-60	16-30	8.0-16.0	7.4-8.4	15-25	---	---	---
721B:								
Corliss	0-7	2-10	3.0-12.0	6.1-7.8	0-15	---	---	---
	7-12	0-10	1.0-6.0	6.1-7.8	0-15	---	---	---
	12-60	0-5	0.0-3.0	7.4-8.4	5-30	---	---	---
765:								
Smiley	0-9	8-20	7.0-22.0	6.6-7.8	0-15	---	---	---
	9-16	18-35	8.0-25.0	6.6-8.4	0-30	---	---	---
	16-60	16-32	8.0-25.0	7.9-8.4	10-30	---	---	---
794:								
Clearriver	0-9	5-15	4.0-13.0	5.1-6.5	---	---	---	---
	9-14	3-10	1.0-6.0	5.1-7.3	---	---	---	---
	14-60	1-5	1.0-3.0	6.6-7.8	1-10	---	---	---
935:								
Hegne	0-8	40-60	26.0-44.0	7.4-8.4	10-20	---	---	---
	8-23	40-60	18.0-36.0	7.4-8.4	15-30	---	0-4	---
	23-60	40-60	18.0-32.0	7.4-8.4	15-30	0-3	0-4	---
Fargo	0-15	40-60	---	6.6-7.8	---	---	0-2	---
	15-31	40-60	---	6.6-8.4	---	---	0-2	---
	31-60	40-60	---	7.9-8.4	---	---	0-2	---
936:								
Clearwater	0-9	10-27	8.0-24.0	6.6-7.8	---	---	---	---
	9-30	35-60	18.0-36.0	7.4-8.4	5-25	---	---	---
	30-60	35-60	18.0-30.0	7.4-8.4	5-25	---	---	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
936:								
Reis------------	0-7	28-40	20.0-32.0	7.4-8.4	10-20	---	---	---
	7-21	40-70	18.0-45.0	7.4-8.4	15-30	---	---	---
	21-60	40-70	10.0-20.0	7.4-8.4	3-15	0-3	0-2	---
937:								
Eaglepoint------	0-10	60-80	10.0-30.0	7.4-8.4	10-15	---	0-4	---
	10-29	60-80	20.0-40.0	7.9-8.4	15-35	---	0-4	---
	29-48	60-80	10.0-30.0	7.4-8.4	10-25	0-1	0-4	---
	48-60	55-75	10.0-30.0	7.4-8.4	5-25	0-3	0-4	---
Northcote--------	0-13	55-75	32.0-50.0	6.6-7.3	---	---	0-4	---
	13-23	60-85	32.0-50.0	6.6-7.8	---	---	0-4	---
	23-60	60-85	30.0-45.0	7.4-8.4	2-15	0-3	0-4	---
972:								
Roliss----------	0-9	18-27	15.0-28.0	6.6-8.4	5-10	---	---	---
	9-17	18-35	10.0-18.0	7.4-8.4	5-15	0-3	---	---
	17-60	18-35	8.0-16.0	7.4-8.4	12-25	0-3	---	---
Vallers---------	0-9	18-27	20.0-32.0	7.4-8.4	12-25	---	0-4	---
	9-15	18-35	10.0-18.0	7.4-8.4	20-35	0-2	0-4	---
	15-60	18-35	8.0-16.0	7.4-8.4	12-25	0-2	0-4	---
1006:								
Fluvaquents-----	0-4	6-18	10.0-33.0	6.6-7.8	---	---	---	---
	4-60	10-27	8.0-17.0	6.6-7.8	0-5	---	---	---
Haploborolls----	0-11	20-35	12.0-24.0	6.6-7.8	---	---	---	---
	11-60	15-30	8.0-16.0	7.4-8.4	---	---	---	---
1030:								
Pits.								
Udipsamments----	0-14	1-15	1.0-5.0	6.6-7.3	---	---	---	---
	14-60	1-10	1.0-3.0	6.6-7.3	---	---	---	---
1031:								
Seelyeville-----	0-14	---	140-200	4.5-7.3	---	---	---	---
	14-60	---	140-200	4.5-7.3	---	---	---	---
1143:								
Berner----------	0-33	---	115-160	5.6-7.3	---	---	---	---
	33-44	0-5	2.0-8.0	6.1-7.8	0-5	---	---	---
	44-60	18-30	10.0-20.0	7.4-8.4	15-35	---	---	---
Markey----------	0-29	---	110-170	4.5-7.8	0-5	---	---	---
	29-60	0-10	1.0-3.0	5.6-8.4	0-5	---	---	---
1144:								
Strathcona------	0-10	12-18	25.0-51.0	7.4-8.4	5-15	---	---	---
	10-16	10-18	5.0-15.0	7.4-8.4	15-30	---	---	---
	16-30	2-8	2.0-8.0	7.4-8.4	5-15	---	---	---
	30-60	15-30	10.0-20.0	7.4-8.4	20-45	---	---	---
Kratka----------	0-9	5-15	5.0-20.0	6.6-7.8	0-10	---	---	---
	9-26	2-10	1.0-8.0	6.6-7.8	0-15	---	---	---
	26-80	10-35	4.0-21.0	6.1-8.4	0-30	---	---	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
1146:								
Northwood-------	0-15	---	100-170	5.1-7.8	---	---	---	---
	15-21	3-18	2.0-20.0	5.6-7.8	---	---	---	---
	21-28	1-10	2.0-7.0	5.6-8.4	0-5	---	---	---
	28-60	7-30	4.0-18.0	7.4-8.4	5-15	---	---	---
1158:								
Skagen----------	0-7	10-18	15.0-30.0	7.4-7.8	2-20	---	---	---
	7-10	10-18	10.0-20.0	7.4-8.4	25-45	---	---	---
	10-21	10-18	5.0-15.0	7.4-8.4	25-45	---	---	---
	21-60	10-18	5.0-15.0	7.4-8.4	15-35	---	---	---
1170:								
Skagen----------	0-10	10-18	15.0-30.0	7.4-7.8	2-20	---	---	---
	10-13	10-18	10.0-20.0	7.4-8.4	25-45	---	---	---
	13-19	10-18	5.0-15.0	7.4-8.4	25-45	---	---	---
	19-60	10-18	5.0-15.0	7.4-8.4	15-35	---	---	---
1187:								
Dora------------	0-31	---	150-230	4.5-7.8	---	---	---	---
	31-42	22-40	125-200	4.5-7.8	---	---	---	---
	42-60	35-60	30.0-60.0	6.1-8.4	5-30	---	---	---
1188:								
Wildwood--------	0-14	---	140-200	5.1-6.5	---	---	---	---
	14-23	60-75	30.0-60.0	5.6-7.3	---	---	---	---
	23-60	50-75	30.0-60.0	7.4-8.4	5-30	---	---	---
1189:								
Clearwater------	0-7	18-27	27.0-56.0	6.1-6.5	---	---	---	---
	7-10	25-60	18.0-42.0	6.6-7.8	0-10	---	---	---
	10-60	35-60	18.0-36.0	7.4-8.4	5-15	---	---	---
1191:								
Sahkahtay-------	0-4	5-15	6.0-15.0	5.6-7.3	---	---	---	---
	4-8	2-10	2.0-8.0	5.6-7.3	---	---	---	---
	8-14	18-30	10.0-16.0	6.1-7.3	---	---	---	---
	14-60	1-8	1.0-4.0	7.4-8.4	5-15	---	---	---
1264:								
Ulen------------	0-10	5-12	5.0-11.0	7.4-8.4	5-15	---	0-4	---
	10-21	5-12	3.0-5.0	7.9-8.4	15-30	---	0-4	---
	21-60	1-7	2.0-3.0	7.4-8.4	5-30	---	0-4	---
1297:								
Augsburg--------	0-9	10-20	10.0-25.0	7.4-8.4	5-30	---	0-2	---
	9-29	5-18	1.0-15.0	7.4-8.4	30-35	0-3	2-4	---
	29-60	35-85	20.0-50.0	7.4-8.4	10-30	0-3	0-2	---
1299:								
Borup-----------	0-8	10-20	8.0-18.0	7.4-8.4	10-25	---	0-4	---
	8-21	10-18	6.0-15.0	7.4-8.4	15-40	---	0-4	---
	21-60	5-18	3.0-10.0	7.4-8.4	10-30	---	0-4	---
1304A:								
Glyndon---------	0-9	15-20	12.0-24.0	7.4-9.0	15-25	---	0-4	---
	9-60	5-18	2.0-10.0	7.4-9.0	15-35	---	0-4	---
1304B:								
Glyndon---------	0-8	15-20	12.0-24.0	7.4-9.0	15-25	---	0-4	---
	8-17	10-18	6.0-14.0	7.4-9.0	20-40	---	0-4	---
	17-60	5-18	2.0-10.0	7.4-9.0	15-35	---	0-4	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
1315A:								
Wheatville------	0-9	5-18	---	7.4-8.4	---	---	0-4	---
	9-29	5-18	---	7.4-8.4	---	---	0-4	---
	29-60	35-80	---	7.4-7.8	---	---	0-4	---
1804:								
Hamre-----------	0-9	---	160-200	5.1-7.8	0-5	---	---	---
	9-21	18-35	16.0-28.0	5.1-7.8	0-10	---	---	---
	21-60	18-35	10.0-22.0	7.4-8.4	5-30	---	---	---
1807:								
Cathro----------	0-20	---	150-230	4.5-7.8	---	---	---	---
	20-36	---	150-230	4.5-7.8	---	---	---	---
	36-60	10-30	2.0-20.0	5.6-8.4	5-25	---	---	---
1808:								
Markey----------	0-40	---	110-170	4.5-7.8	0-5	---	---	---
	40-60	0-10	1.0-3.0	5.6-8.4	0-5	---	---	---
1871:								
Fargo-----------	0-12	40-65	---	6.6-7.8	---	---	---	---
	12-37	40-65	---	6.6-8.4	---	---	---	---
	37-60	40-65	---	7.9-8.4	---	---	---	---
1874:								
Radium----------	0-14	1-8	3.0-12.0	6.1-7.8	0-5	---	---	---
	14-33	1-8	2.0-8.0	6.6-8.4	2-10	---	---	---
	33-43	1-8	1.0-5.0	7.4-8.4	5-15	---	---	---
	43-60	1-5	1.0-5.0	7.4-8.4	5-15	---	---	---
1878:								
Hamre-----------	0-9	---	160-200	5.1-7.8	0-5	---	---	---
	9-14	18-35	16.0-28.0	5.1-7.8	0-10	---	---	---
	14-60	18-35	10.0-22.0	7.4-8.4	5-30	---	---	---
1882:								
Rosewood---------	0-8	8-18	8.0-24.0	7.9-8.4	5-15	---	---	---
	8-27	6-18	5.0-15.0	7.9-8.4	15-30	---	---	---
	27-60	1-6	1.0-4.0	7.4-8.4	5-20	---	---	---
Strathcona------	0-9	12-20	15.0-35.0	7.4-8.4	5-15	---	---	---
	9-21	2-8	2.0-8.0	7.4-8.4	5-15	---	---	---
	21-60	15-30	10.0-20.0	7.4-8.4	20-45	---	---	---
Berner----------	0-21	---	115-160	5.6-7.3	---	---	---	---
	21-35	0-5	2.0-8.0	6.1-7.8	0-5	---	---	---
	35-60	18-30	10.0-20.0	7.4-8.4	15-35	---	---	---
1963:								
Bearden---------	0-10	27-39	15.0-30.0	7.4-8.4	1-10	---	0-4	---
	10-17	18-34	10.0-25.0	7.4-8.4	10-20	0-2	0-4	0-1
	17-60	18-34	10.0-20.0	7.4-8.4	15-35	0-3	0-4	0-1
Colvin----------	0-9	27-34	25.0-40.0	6.6-8.4	0-10	0-1	---	0-2
	9-21	18-34	15.0-25.0	7.4-9.0	10-45	0-1	---	0-3
	21-60	18-34	10.0-20.0	7.4-8.4	5-20	0-5	---	0-10
1964:								
Colvin----------	0-11	27-34	25.0-40.0	6.6-8.4	0-10	0-1	---	0-2
	11-19	18-34	15.0-25.0	7.4-9.0	10-45	0-1	---	0-3
	19-60	18-34	10.0-20.0	7.4-8.4	5-20	0-5	---	0-10

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
1964:								
Fargo-----------	0-14	40-60	---	6.6-7.8	---	---	0-2	---
	14-26	40-60	---	6.6-8.4	---	---	0-2	---
	26-60	40-60	---	7.9-8.4	---	---	0-2	---
1966:								
Rosewood--------	0-11	8-18	8.0-24.0	7.4-8.4	5-20	---	---	---
	11-18	6-18	5.0-15.0	7.4-8.4	15-30	---	---	---
	18-60	1-6	1.0-4.0	7.4-8.4	5-25	---	---	---
Hamar-----------	0-16	5-10	7.0-12.0	6.1-7.8	---	---	0-2	---
	16-60	0-7	3.0-9.0	7.4-8.4	0-2	---	0-2	---

Water Features

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Hydrologic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
47:									
Colvin----------	C/D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
57A:									
Fargo-----------	D	None-------	---	---	0.0-1.5	Apparent---	Sep-Jun	---	---
58:									
Kittson---------	C	None-------	---	---	2.5-3.5	Apparent---	Mar-Jun	---	---
59:									
Grimstad--------	B	None-------	---	---	2.5-3.5	Apparent---	Apr-Jul	---	---
65:									
Foxhome---------	B	None-------	---	---	2.5-3.5	Apparent---	Mar-Jun	---	---
66:									
Flaming---------	A	None-------	---	---	2.5-3.5	Apparent---	Mar-Jun	---	---
67A:									
Bearden---------	C	None-------	---	---	1.5-3.5	Apparent---	Apr-Jun	---	---
67B:									
Bearden---------	C	None-------	---	---	1.5-3.5	Apparent---	Apr-Jun	---	---
77:									
Garnes----------	B	None-------	---	---	2.5-3.5	Apparent---	Apr-Jun	---	---
93A:									
Bearden---------	C	None-------	---	---	1.5-3.5	Apparent---	Apr-Jun	---	---
111:									
Hangaard--------	D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
116:									
Redby-----------	B	None-------	---	---	1.5-2.5	Apparent---	Apr-Jul	---	---
117:									
Cormant---------	A/D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
145:									
Enstrom---------	B	None-------	---	---	2.5-3.5	Apparent---	Apr-Jul	---	---
148:									
Poppleton-------	A	None-------	---	---	2.5-3.5	Apparent---	Mar-Jun	---	---
157A:									
Wahpeton--------	C	Occasional	Brief-----	Mar-Jun	2.5-3.5	---	---	---	---
157B:									
Wahpeton--------	C	Occasional	Brief-----	Mar-Jun	2.5-3.5	---	---	---	---
184A:									
Hamerly---------	C	None-------	---	---	1.5-3.5	Apparent---	Apr-Jun	---	---
187:									
Haug------------	B/D	None-------	---	---	+1.0-1.0	Apparent---	Jan-Dec	---	1.0

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
205:									
Karlstad----------	A	None--------	---	---	2.5-3.5	Apparent---	Apr-Jul	---	---
236:									
Vallers----------	C	None--------	---	---	0.5-1.5	Apparent---	Apr-Jun	---	---
242B:									
Marquette--------	A	None--------	---	---	>6.0	---	---	---	---
258B:									
Sandberg---------	A	None--------	---	---	>6.0	---	---	---	---
280:									
Pelan------------	B	None--------	---	---	2.5-3.5	Apparent---	Apr-Jul	---	---
372:									
Hamar------------	A/D	None--------	---	---	0.0-1.5	Apparent---	Mar-Jun	---	---
379:									
Percy------------	B/D	None--------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
383:									
Percy------------	B/D	None--------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
384:									
Percy------------	B/D	None--------	---	---	+1.0-0.5	Apparent---	Sep-Jun	---	1.0
387:									
Roliss-----------	B/D	None--------	---	---	+0.5-1.0	Apparent---	Oct-Jul	---	0.5
412:									
Mavie------------	B/D	None--------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
418:									
Lamoure----------	C	Occasional	Brief------	Mar-Oct	0.0-1.5	Apparent---	Oct-Jun	---	---
426:									
Foldahl----------	B	None--------	---	---	2.5-3.5	Apparent---	Mar-Jun	---	---
429A:									
Northcote--------	C/D	None--------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
432:									
Strandquist------	B/D	None--------	---	---	0.5-1.5	Apparent---	Mar-Jun	---	---
435:									
Syrene-----------	B/D	None--------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
439:									
Strathcona-------	B/D	None--------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
481:									
Kratka-----------	B/D	None--------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
482:									
Grygla-----------	B/D	None--------	---	---	0.5-1.5	Apparent---	Mar-Jul	---	---
514:									
Tacoosh----------	B/D	None--------	---	---	+1.0-1.0	Apparent---	Sep-May	---	1.0

Water Features--Continued

Map symbol and soil name	Hydro- logic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
540:									
Seelyeville-----	A/D	None-------	---	---	+1.0-0.5	Apparent---	Oct-Jun	---	1.0
541:									
Rifle-----------	A/D	None-------	---	---	+1.0-1.0	Apparent---	Nov-Jun	---	1.0
543:									
Markey----------	A/D	None-------	---	---	+1.0-1.0	Apparent---	Nov-Jun	---	1.0
544:									
Cathro----------	A/D	None-------	---	---	+1.0-1.0	Apparent---	Oct-Jun	---	1.0
546:									
Lupton----------	A/D	None-------	---	---	0.0-1.0	Apparent---	Sep-May	---	---
547:									
Deerwood--------	B/D	None-------	---	---	+1.0-1.0	Apparent---	Jan-Dec	---	1.0
550:									
Dora------------	B/D	None-------	---	---	+1.0-0.5	Apparent---	Nov-May	---	1.0
563:									
Northwood-------	B/D	None-------	---	---	+1.0-0.5	Apparent---	Nov-Jul	---	1.0
565:									
Eckvoll---------	B	None-------	---	---	1.5-2.5	Apparent---	Mar-Jun	---	---
582:									
Roliss----------	B/D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
583:									
Nereson---------	B	None-------	---	---	2.5-3.5	Apparent---	Mar-Jun	---	---
630:									
Wildwood--------	D	None-------	---	---	+1.0-0.5	Apparent---	Sep-Jun	---	1.0
641:									
Clearwater------	D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
642:									
Clearwater------	D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
643:									
Huot------------	B	None-------	---	---	2.5-3.5	Apparent---	Apr-Jul	---	---
644:									
Boash-----------	D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jun	---	---
645:									
Espelie---------	B/D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jun	---	---
647:									
Hilaire---------	B	None-------	---	---	2.5-3.5	Apparent---	Apr-Jun	---	---
648:									
Newfolden-------	C	None-------	---	---	2.5-3.5	Apparent---	Mar-Jun	---	---
649:									
Reiner----------	B	None-------	---	---	2.5-3.5	Apparent---	Apr-Jul	---	---
650:									
Reiner----------	B	None-------	---	---	2.5-3.5	Apparent---	Apr-Jul	---	---

Water Features--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
651:									
Thiefriver	B/D	None	---	---	0.5-1.5	Apparent	Mar-Jun	---	---
652:									
Wyandotte	D	None	---	---	0.5-1.5	Apparent	Apr-Jul	---	---
653:									
Smiley	B/D	None	---	---	+1.0-0.5	Apparent	Jan-Dec	---	1.0
708:									
Rushlake	A	None	---	---	2.5-3.5	Apparent	Jan-Dec	---	---
712:									
Rosewood	A/D	None	---	---	0.5-1.5	Apparent	Apr-Jun	---	---
713:									
Linveldt	B	None	---	---	2.5-3.5	Apparent	Apr-Jul	---	---
721B:									
Corliss	A	None	---	---	>6.0	---	---	---	---
765:									
Smiley	B/D	None	---	---	0.5-1.5	Apparent	Apr-Jul	---	---
794:									
Clearriver	B	None	---	---	2.0-3.5	Apparent	Apr-Jun	---	---
935:									
Hegne	D	None	---	---	0.5-1.5	Apparent	Apr-Jun	---	---
Fargo	D	None	---	---	0.0-1.5	Apparent	Sep-Jun	---	---
936:									
Clearwater	D	None	---	---	0.5-1.5	Apparent	Apr-Jul	---	---
Reis	D	None	---	---	0.5-1.5	Apparent	Apr-Jun	---	---
937:									
Eaglepoint	D	None	---	---	1.5-2.5	Apparent	Apr-Jul	---	---
Northcote	C/D	None	---	---	0.5-1.5	Apparent	Apr-Jul	---	---
972:									
Roliss	B/D	None	---	---	0.5-1.5	Apparent	Apr-Jul	---	---
Vallers	C	None	---	---	0.5-1.5	Apparent	Apr-Jun	---	---
1006:									
Fluvaquents	D	Frequent	Long	Mar-Jul	0.0-3.0	Apparent	Mar-Feb	---	---
Haploborolls	C	Rare	---	---	2.5-5.0	---	---	---	---
1030:									
Pits.									
Udipsamments	A	None	---	---	>6.0	---	---	---	---
1031:									
Seelyeville	D	None	---	---	+3.0-0.0	Apparent	Jan-Dec	---	3.0

Water Features--Continued

		Flooding			High water table and ponding				
Map symbol and soil name	Hydrologic group	Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
1143:									
Berner----------	A/D	None-------	---	---	+1.0-0.5	Apparent---	Nov-Jun	---	1.0
Markey----------	A/D	None-------	---	---	+1.0-1.0	Apparent---	Nov-Jun	---	1.0
1144:									
Strathcona------	B/D	None-------	---	---	+1.0-0.5	Apparent---	Jan-Dec	---	1.0
Kratka----------	B/D	None-------	---	---	+1.0-0.5	Apparent---	Oct-Jul	---	1.0
1146:									
Northwood-------	B/D	None-------	---	---	+2.0-0.0	Apparent---	Jan-Dec	---	2.0
1158:									
Skagen----------	C	None-------	---	---	2.5-3.5	Apparent---	Mar-Jun	---	---
1170:									
Skagen----------	C	None-------	---	---	2.5-3.5	Apparent---	Mar-Jun	---	---
1187:									
Dora------------	D	None-------	---	---	+2.0-0.0	Apparent---	Jan-Dec	---	2.0
1188:									
Wildwood--------	D	None-------	---	---	+2.0-0.0	Apparent---	Jan-Dec	---	2.0
1189:									
Clearwater------	D	None-------	---	---	+1.0-0.5	Apparent---	Jan-Dec	---	1.0
1191:									
Sahkahtay-------	B	None-------	---	---	0.5-1.5	Apparent---	Apr-Jun	---	---
1264:									
Ulen------------	B	None-------	---	---	2.5-3.5	Apparent---	Apr-Jul	---	---
1297:									
Augsburg--------	B/D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
1299:									
Borup-----------	B/D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
1304A:									
Glyndon---------	B	None-------	---	---	2.5-3.5	Apparent---	Apr-Jun	---	---
1304B:									
Glyndon---------	B	None-------	---	---	2.5-3.5	Apparent---	Apr-Jun	---	---
1315A:									
Wheatville------	B	None-------	---	---	2.5-3.5	Apparent---	Apr-Jul	---	---
1804:									
Hamre-----------	C/D	None-------	---	---	+1.0-1.0	Apparent---	Jan-Dec	---	1.0
1807:									
Cathro----------	D	None-------	---	---	+3.0-0.5	Apparent---	Jan-Dec	---	3.0
1808:									
Markey----------	A/D	None-------	---	---	+1.0-1.0	Apparent---	Jan-Dec	---	1.0
1871:									
Fargo-----------	D	Rare-------	---	---	+0.5-1.0	Apparent---	Jan-Dec	---	0.5

Water Features--Continued

Map symbol and soil name	Hydro- logic group	Flooding			High water table and ponding				
		Frequency	Duration	Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
1874:									
Radium----------	A	None-------	---	---	2.5-3.5	Apparent---	Apr-Oct	---	---
1878:									
Hamre-----------	C/D	None-------	---	---	+1.0-1.0	Apparent---	Jan-Dec	---	1.0
1882:									
Rosewood--------	D	None-------	---	---	0.0-1.0	Apparent---	Jan-Dec	---	---
Strathcona------	B/D	None-------	---	---	0.0-0.5	Apparent---	Jan-Dec	---	---
Berner----------	A/D	None-------	---	---	0.0-0.5	Apparent---	Jan-Dec	---	---
1963:									
Bearden---------	C	None-------	---	---	1.5-3.5	Apparent---	Apr-Jun	---	---
Colvin----------	C/D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
1964:									
Colvin----------	C/D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jul	---	---
Fargo-----------	D	None-------	---	---	0.0-1.5	Apparent---	Sep-Jun	---	---
1966:									
Rosewood--------	A/D	None-------	---	---	0.5-1.5	Apparent---	Apr-Jun	---	---
Hamar-----------	A/D	None-------	---	---	0.0-1.5	Apparent---	Oct-Jun	---	---

Soil Features

(Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
47:							
Colvin----------	>60	---	---	---	High--------	High--------	Low.
57A:							
Fargo-----------	>60	---	---	---	High--------	High--------	Low.
58:							
Kittson---------	>60	---	---	---	High--------	High--------	Low.
59:							
Grimstad--------	>60	---	---	---	Moderate----	Moderate----	Low.
65:							
Foxhome---------	>60	---	---	---	High--------	Moderate----	Low.
66:							
Flaming---------	>60	---	---	---	Moderate----	Low---------	Low.
67A:							
Bearden---------	>60	---	---	---	High--------	High--------	Low.
67B:							
Bearden---------	>60	---	---	---	High--------	High--------	Low.
77:							
Garnes----------	>60	---	---	---	High--------	Moderate----	Low.
93A:							
Bearden---------	>60	---	---	---	High--------	High--------	Low.
111:							
Hangaard--------	>60	---	---	---	Moderate----	High--------	Low.
116:							
Redby-----------	>60	---	---	---	Moderate----	Low---------	Low.
117:							
Cormant---------	>60	---	---	---	Moderate----	High--------	Low.
145:							
Enstrom---------	>60	---	---	---	Moderate----	Moderate----	Low.
148:							
Poppleton-------	>60	---	---	---	Moderate----	Low---------	Low.
157A:							
Wahpeton--------	>60	---	---	---	High--------	High--------	Low.
157B:							
Wahpeton--------	>60	---	---	---	High--------	High--------	Low.
184A:							
Hamerly---------	>60	---	---	---	High--------	High--------	Low.
187:							
Haug------------	>60	---	---	---	High--------	High--------	Low.
205:							
Karlstad--------	>60	---	---	---	Moderate----	Low---------	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
236:							
Vallers	>80	---	---	---	High	High	Low.
242B:							
Marquette	>60	---	---	---	Low	Low	Low.
258B:							
Sandberg	>60	---	---	---	Low	Moderate	Low.
280:							
Pelan	>60	---	---	---	Moderate	Moderate	Low.
372:							
Hamar	>60	---	---	---	Moderate	High	Low.
379:							
Percy	>60	---	---	---	High	High	Low.
383:							
Percy	>60	---	---	---	High	High	Low.
384:							
Percy	>60	---	---	---	High	High	Low.
387:							
Roliss	>60	---	---	---	High	High	Low.
412:							
Mavie	>60	---	---	---	High	High	Low.
418:							
Lamoure	>60	---	---	---	High	High	Moderate.
426:							
Foldahl	>60	---	---	---	High	Moderate	Low.
429A:							
Northcote	>60	---	---	---	High	High	Low.
432:							
Strandquist	>60	---	---	---	High	High	Low.
435:							
Syrene	>60	---	---	---	Moderate	High	Low.
439:							
Strathcona	>60	---	---	---	High	High	Low.
481:							
Kratka	>60	---	---	---	Moderate	High	Low.
482:							
Grygla	>60	---	---	---	High	High	Low.
514:							
Tacoosh	>60	---	4-20	9-29	High	High	Moderate.
540:							
Seelyeville	>60	---	---	50-55	High	High	Moderate.
541:							
Rifle	>60	---	---	---	High	High	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
543:							
Markey-----------	>60	---	---	25-30	High--------	High--------	Low.
544:							
Cathro-----------	>60	---	---	19-22	High--------	High--------	Low.
546:							
Lupton-----------	>60	---	6-18	50-55	High--------	High--------	Low.
547:							
Deerwood---------	>60	---	---	5-10	Moderate----	High--------	Low.
550:							
Dora-------------	>60	---	4-12	25-30	High--------	High--------	Moderate.
563:							
Northwood--------	>60	---	0-3	8-10	High--------	High--------	Low.
565:							
Eckvoll----------	>60	---	---	---	High--------	Moderate----	Low.
582:							
Roliss-----------	>60	---	---	---	High--------	High--------	Low.
583:							
Nereson----------	>60	---	---	---	High--------	Moderate----	Low.
630:							
Wildwood---------	>60	---	0-6	6-12	High--------	High--------	Low.
641:							
Clearwater-------	>60	---	---	---	High--------	High--------	Low.
642:							
Clearwater-------	>60	---	---	---	High--------	High--------	Low.
643:							
Huot-------------	>80	---	---	---	High--------	High--------	Low.
644:							
Boash------------	>60	---	---	---	High--------	High--------	Low.
645:							
Espelie----------	>60	---	---	---	High--------	High--------	Low.
647:							
Hilaire----------	>60	---	---	---	High--------	Moderate----	Low.
648:							
Newfolden--------	>60	---	---	---	High--------	Moderate----	Low.
649:							
Reiner-----------	>60	---	---	---	High--------	Moderate----	Low.
650:							
Reiner-----------	>60	---	---	---	High--------	Moderate----	Low.
651:							
Thiefriver-------	>60	---	---	---	High--------	High--------	Low.
652:							
Wyandotte--------	>60	---	---	---	High--------	High--------	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
653:							
Smiley----------	>60	---	---	---	High--------	High--------	Low.
708:							
Rushlake--------	>60	---	---	---	Moderate----	Moderate----	Low.
712:							
Rosewood--------	>60	---	---	---	Moderate----	High--------	Low.
713:							
Linveldt--------	>60	---	---	---	High--------	Moderate----	Low.
721B:							
Corliss---------	>60	---	---	---	Low---------	Low---------	Low.
765:							
Smiley----------	>60	---	---	---	High--------	High--------	Low.
794:							
Clearriver------	>60	---	---	---	Low---------	Low---------	Moderate.
935:							
Hegne-----------	>80	---	---	---	Moderate----	High--------	Low.
Fargo-----------	>60	---	---	---	High--------	High--------	Low.
936:							
Clearwater------	>60	---	---	---	High--------	High--------	Low.
Reis------------	>80	---	---	---	High--------	High--------	Low.
937:							
Eaglepoint------	>60	---	---	---	Moderate----	High--------	Low.
Northcote-------	>60	---	---	---	High--------	High--------	Low.
972:							
Roliss----------	>60	---	---	---	High--------	High--------	Low.
Vallers---------	>80	---	---	---	High--------	High--------	Low.
1006:							
Fluvaquents-----	>60	---	---	---	High--------	High--------	Low.
Haploborolls----	>60	---	---	---	Moderate----	Moderate----	Low.
1030:							
Pits.							
Udipsamments----	>60	---	---	---	Low---------	Low---------	Low.
1031:							
Seelyeville-----	>60	---	---	---	High--------	High--------	Moderate.
1143:							
Berner----------	>60	---	---	19-22	High--------	High--------	Moderate.
Markey----------	>60	---	---	25-30	High--------	High--------	Low.
1144:							
Strathcona------	>60	---	---	---	High--------	High--------	Low.
Kratka----------	>60	---	---	---	Moderate----	High--------	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
1146:							
Northwood-------	>60	---	0-3	8-10	High--------	High--------	Low.
1158:							
Skagen----------	>60	---	---	---	High--------	High--------	Low.
1170:							
Skagen----------	>60	---	---	---	High--------	High--------	Low.
1187:							
Dora------------	>60	---	---	---	High--------	High--------	Low.
1188:							
Wildwood--------	>60	---	0-6	6-12	High--------	High--------	Low.
1189:							
Clearwater------	>60	---	---	---	High--------	High--------	Low.
1191:							
Sahkahtay-------	>60	---	---	---	Moderate----	High--------	Low.
1264:							
Ulen------------	>60	---	---	---	Moderate----	Low---------	Low.
1297:							
Augsburg--------	>60	---	---	---	High--------	High--------	Low.
1299:							
Borup-----------	>60	---	---	---	High--------	High--------	Low.
1304A:							
Glyndon---------	>60	---	---	---	High--------	High--------	Low.
1304B:							
Glyndon---------	>60	---	---	---	High--------	High--------	Low.
1315A:							
Wheatville------	>60	---	---	---	High--------	High--------	Low.
1804:							
Hamre-----------	>60	---	---	---	High--------	High--------	Low.
1807:							
Cathro----------	>60	---	---	---	High--------	High--------	Low.
1808:							
Markey----------	>60	---	---	25-30	High--------	High--------	Low.
1871:							
Fargo-----------	>60	---	---	---	High--------	High--------	Low.
1874:							
Radium----------	>60	---	---	---	Low---------	Moderate----	Low.
1878:							
Hamre-----------	>60	---	---	---	High--------	High--------	Low.
1882:							
Rosewood--------	>60	---	---	---	High--------	High--------	Low.
Strathcona------	>60	---	---	---	High--------	High--------	Low.
Berner----------	>60	---	---	19-22	High--------	High--------	Moderate.

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
1963:							
Bearden----------	>60	---	---	---	High---------	High---------	Low.
Colvin------------	>60	---	---	---	High---------	High---------	Low.
1964:							
Colvin------------	>60	---	---	---	High---------	High---------	Low.
Fargo-------------	>60	---	---	---	High---------	High---------	Low.
1966:							
Rosewood---------	>60	---	---	---	Moderate-----	High---------	Low.
Hamar-------------	>60	---	---	---	Moderate-----	High---------	Low.

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Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Aspect. The direction in which a slope faces.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes. Backslopes in profile are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Channery soil material. Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the surface after planting in order to reduce the hazard of water erosion; in areas where wind erosion is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or its equivalent during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. The thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have an intermediate or high water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of most field crops are affected. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted under natural conditions. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poor drainage is caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except for rice) under natural conditions.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. The term is more often applied to cliffs resulting from differential erosion.

Esker. A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is generally a constructional landform consisting of sediment deposited during overflow and lateral migration of the stream.

Footslope. The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface is dominantly concave. In terms of gradational processes, a footslope is a transition zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Geomorphology. The science that treats the general configuration of the earth's surface; specifically the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and the history of geologic changes as recorded by these surface features. The term is especially applied to the genetic interpretation of landforms.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-chroma zones. Zones having chroma of 3 or more. Typical color in areas of iron concentrations.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 6 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Ice-walled lake plain. A relict surface marking the floor of an extinct lake basin that was formed on solid ground and surrounded by stagnant ice in a stable or unstable superglacial environment on stagnation moraines. As the ice melted, the lake plain became perched above the adjacent landscape. The lake plain is well sorted, generally fine textured, stratified deposits.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Iron concentrations. High-chroma zones having a high content of iron and manganese oxide because of chemical oxidation and accumulation, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic concentration.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame. An irregular, short ridge or hill of stratified glacial drift.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake bed. The bottom of a lake; a lake basin.

Lake plain. A nearly level surface marking the floor of an extinct lake filled by well-sorted, generally fine-textured, stratified deposits, commonly containing varves.

Lakeshore. A narrow strip of land in contact with or bordering a lake; especially the beach of a lake.

Lake terrace. A narrow shelf, partly cut and partly built, produced along a lake shore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches

(7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low-chroma zones. Zones having chroma of 2 or less. Typical color in areas of iron depletions.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of glacial drift in a topographic landform resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Extremely slow	less than 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	less than 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables). Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The hillslope position that forms the uppermost inclined surface near the top of a hillslope. It comprises the transition zone from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of rock fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter or loosen a layer that restricts roots.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summit. The topographically highest position of a hillslope profile and exhibiting a nearly level surface. A general term for the top, or highest level of a landform, such as a hill, mountain, or tableland. It usually refers to a high interfluve area of gentler slope that is flanked by steeper hillslopes, for example, mountain fronts or tableland escarpments.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Swale. A slight depression in the midst of generally level land. A shallow depression in an undulating ground moraine due to uneven glacial deposition.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Till plain. An extensive area of nearly level to undulating or gently sloping soils that are underlain by till or consist of till. Slopes are 0 to 6 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as salts, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.

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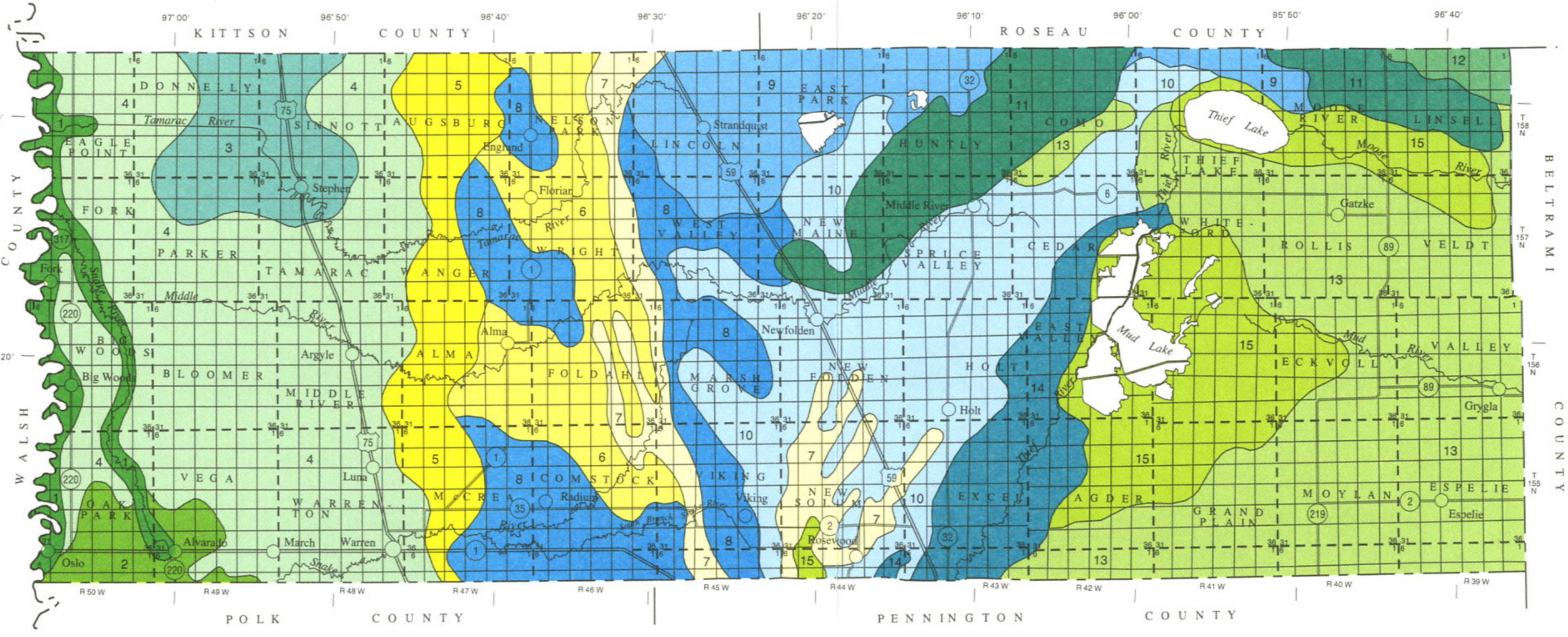
97°00'
96°50'
96°40'
96°30'
96°20'
96°10'
96°00'
95°50'
96°40'
KITTSON COUNTY
ROSEAU COUNTY
BELTRAMI COUNTY
PENNINGTON COUNTY
POLK COUNTY
WALSH COUNTY
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48°30'
48°20'
T 158 N
T 157 N
T 156 N
T 155 N
R 50 W
R 49 W
R 48 W
R 47 W
R 46 W
R 45 W
R 44 W
R 43 W
R 42 W
R 41 W
R 40 W
R 39 W
DONNELLY
SINNOTT
AUGSBURG
NELSON PARK
LINCOLN
EAST PARK
HUNTLY
COMO
MOOSE RIVER
LINSELL
EAGLE POINT
THIEF LAKE
FORK
PARKER
TAMARAC
WANGER
WRIGHT
WEST VALLEY
NEW MAINE
SPRUCE VALLEY
CEDAR
WHITE-FORD
ROLLIS
VELDT
BIG WOODS
BLOOMER
MIDDLE RIVER
ALMA
FOLDAHL
MARSH GROVE
NEW FOLDEN
HOLT
EAST VALLEY
ECKVOLL
VALLEY
VEGA
WARREN-TON
McCREA
COMSTOCK
VIKING
NEW SOLUM
EXCEL
AGDER
GRAND PLAIN
MOYLAN
ESPELIE
OAK PARK
Strandquist
Stephen
Englund
Florian
Middle River
Gatzke
Fork
Newfolden
Argyle
Alma
Big Woods
Holt
Grygla
Luna
Radium
Viking
Rosewood
Oslo
Alvarado
March
Warren
Espelie
Tamarac River
Middle River
Snake River
Thief River
Moose River
Mud River
Branch
Thief Lake
Mud Lake
75
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15

SOIL LEGEND*

1	Wahpeton-Fargo-association
2	Colvin-Bearden association
3	Northcote-Eaglepoint association
4	Fargo-Colvin-Hegne association
5	Wheatville-Glyndon association
6	Ulen-Flaming association
7	Sandberg-Strathcona-Syrene association
8	Grimstad-Strathcona-Vallers association
9	Percy-Strathcona-Mavie association
10	Roliss-Vallers-Mavie association
11	Karlstad-Deerwood-Syrene association
12	Redby-Northwood-Cormant association
13	Smiley-Kratka-Reiner association
14	Clearwater-Wyandotte association
15	Cathro-Dora-Wildwood association

*The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1994

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
MINNESOTA AGRICULTURAL EXPERIMENT STATION

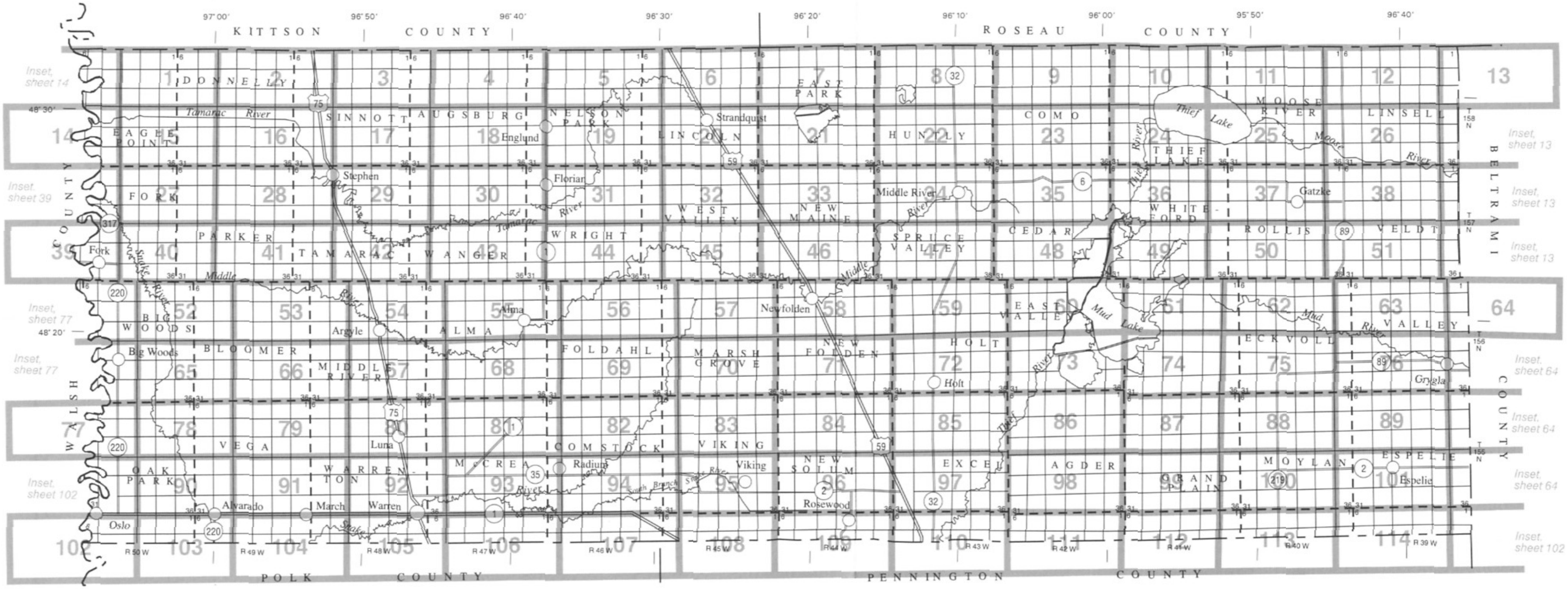
GENERAL SOIL MAP
MARSHALL COUNTY, MINNESOTA

Scale 1:380160

1 0 1 2 3
MILES

1 0 1 2 3 4 5 6
KILOMETERS

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.


KITTSON COUNTY
ROSEAU COUNTY
BELTRAMI COUNTY
POLK COUNTY
PENNINGTON COUNTY
WALSH COUNTY
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97° 00'
96° 50'
96° 40'
96° 30'
96° 20'
96° 10'
96° 00'
95° 50'
48° 30'
48° 20'
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T 157 N
T 156 N
T 155 N
R 50 W
R 49 W
R 48 W
R 47 W
R 46 W
R 45 W
R 44 W
R 43 W
R 42 W
R 41 W
R 40 W
R 39 W
Inset, sheet 14
Inset, sheet 39
Inset, sheet 77
Inset, sheet 102
Inset, sheet 13
Inset, sheet 64
DONNELLY
EAGLE POINT
SINNOTT
AUGSBURG
NELSON PARK
LINCOLN
EAST PARK
HUNTLY
COMO
MOOSE RIVER
LINSELL
THIEF LAKE
FORK
WEST VALLEY
NEW MAINE
SPRUCE VALLEY
CEDAR
WHITE-FORD
ROLLIS
VELDT
PARKER
TAMARAC
WANGER
WRIGHT
BIG WOODS
BLOOMER
MIDDLE RIVER
ALMA
FOLDAHL
MARSH GROVE
NEW FOLDEN
HOLT
EAST VALLEY
ECKVOLL
VALLEY
VEGA
OAK PARK
WARRENTON
McCREA
COMSTOCK
VIKING
NEW SOLUM
EXCEL
AGDER
GRAND PLAIN
MOYLAN
ESPELIE
Stephen
Englund
Florian
Strandquist
Middle River
Gatzke
Fork
Argyle
Alma
Newfolden
Big Woods
Holt
Grygla
Luna
Radium
Viking
Alvarado
March
Warren
Rosewood
Espelie
Oslo
Tamarac River
Middle River
Snake River
South Branch Snake River
Thief River
Moose River
Mud River
Thief Lake
Mud Lake
75
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14 15 16 17 18 19 20 21 22 23 24 25 26
27 28 29 30 31 32 33 34 35 36 37 38
39 40 41 42 43 44 45 46 47 48 49 50 51
52 53 54 55 56 57 58 59 60 61 62 63 64
65 66 67 68 69 70 71 72 73 74 75 76
77 78 79 80 81 82 83 84 85 86 87 88 89
90 91 92 93 94 95 96 97 98 99 100 101
102 103 104 105 106 107 108 109 110 111 112 113 114

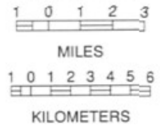
SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

MARSHALL COUNTY, MINNESOTA

Scale 1:380160


1 0 1 2 3
MILES
1 0 1 2 3 4 5 6
KILOMETERS

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
47	Colvin silty clay loam
57A	Fargo silty clay, 0 to 2 percent slopes
58	Kittson loam
59	Grimstad fine sandy loam
65	Foxhome sandy loam
66	Flaming loamy fine sand
67A	Bearden silt loam, 0 to 2 percent slopes
67B	Bearden silt loam, 2 to 6 percent slopes
77	Garnes fine sandy loam
93A	Bearden silty clay loam, 0 to 2 percent slopes
111	Hangaard sandy loam
116	Redby loamy fine sand
117	Cormant loamy fine sand
145	Enstrom loamy fine sand
148	Poppleton fine sand
157A	Wahpeton silty clay, 0 to 2 percent slopes, occasionally flooded
157B	Wahpeton silty clay, 2 to 6 percent slopes, occasionally flooded
184A	Hamerly loam, 0 to 3 percent slopes
187	Haug muck
205	Karlstad loamy sand
236	Vallers loam
242B	Marquette loamy sand, 1 to 8 percent slopes
258B	Sandberg loamy sand, 1 to 6 percent slopes
280	Pelan sandy loam
372	Hamar loamy fine sand
379	Percy loam, very cobbly
383	Percy loam
384	Percy mucky loam, depressional
387	Roliss loam, depressional
412	Mavie fine sandy loam
418	Lamoure silty clay loam, occasionally flooded
426	Foldahl loamy fine sand
429A	Northcote clay, 0 to 2 percent slopes
432	Strandquist loam
435	Syrene sandy loam
439	Strathcona fine sandy loam
481	Kratka fine sandy loam
482	Grygla loamy fine sand
514	Tacoosh muck
540	Seelyeville muck
541	Rifle mucky peat
543	Markey muck
544	Cathro muck
546	Lupton muck
547	Deerwood muck
550	Dora muck
563	Northwood muck
565	Eckvoll loamy fine sand
582	Roliss loam
583	Nereson fine sandy loam

SYMBOL	NAME
630	Wildwood muck
641	Clearwater clay
642	Clearwater loam
643	Huot fine sandy loam
644	Boash clay loam
645	Espelie fine sandy loam
647	Hilaire loamy fine sand
648	Newfolden loam
649	Reiner loamy fine sand
650	Reiner fine sandy loam
651	Thiefriver fine sandy loam
652	Wyandotte clay loam
653	Smiley mucky loam, depressional
708	Rushlake loamy sand
712	Rosewood fine sandy loam
713	Linveldt fine sandy loam
721B	Corliss loamy sand, 1 to 6 percent slopes
765	Smiley loam
794	Clearriver loamy fine sand
935	Hegne-Fargo complex
936	Clearwater-Reis complex
937	Eaglepoint-Northcote complex
972	Roliss-Vallers complex
1006	Fluvaquents-Haploborolls complex, 0 to 30 percent slopes, flooded
1030	Pits, gravel-Udipsamments complex
1031	Seelyeville muck, ponded
1143	Berner-Markey complex
1144	Strathcona and Kratka soils, depressional
1146	Northwood muck, ponded
1158	Skagen loam
1170	Skagen loam, very cobbly
1187	Dora muck, ponded
1188	Wildwood muck, ponded
1189	Clearwater mucky loam, depressional
1191	Sahkahtay sandy loam
1264	Ulen loamy fine sand
1297	Augsburg very fine sandy loam
1299	Borup very fine sandy loam
1304A	Glyndon very fine sandy loam, 0 to 2 percent slopes
1304B	Glyndon very fine sandy loam, 2 to 6 percent slopes
1315A	Wheatville very fine sandy loam, 0 to 2 percent slopes
1804	Hamre muck, ponded
1807	Cathro muck, ponded
1808	Markey muck, ponded
1871	Fargo silty clay, swales
1874	Radium loamy sand
1878	Hamre muck
1882	Rosewood, Strathcona, and Berner soils, seepy
1963	Bearden-Colvin complex
1964	Colvin-Fargo complex
1966	Rosewood-Hamar complex

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state, or province ——— – –
- County or parish ——— –
- Reservation (national forest or park, state forest or park, and large airport) —— · ——
- Field sheet matchline and neatline ————

AD HOC BOUNDARY
(label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool FLOOD POOL LINE

STATE COORDINATE TICK
1 890 000 FEET ——┴——

LAND DIVISION CORNER
(sections and land grants) └ ┴ ┼ ┼

ROAD EMBLEM & DESIGNATIONS

- Federal 287
- State (52)

LEVEES

- Without road
- With road

DAMS

- Large (to scale)
- Medium or Small (Named where applicable) Water

PITS

- Gravel pit ⚒

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Drainage and/or irrigation ──►── · ──

LAKES, PONDS, AND RESERVOIRS

- Perennial Water
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring o~
- *Wet spot Ѱ

*Not to be used with poorly drained and very poorly drained soils.

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS 59 77

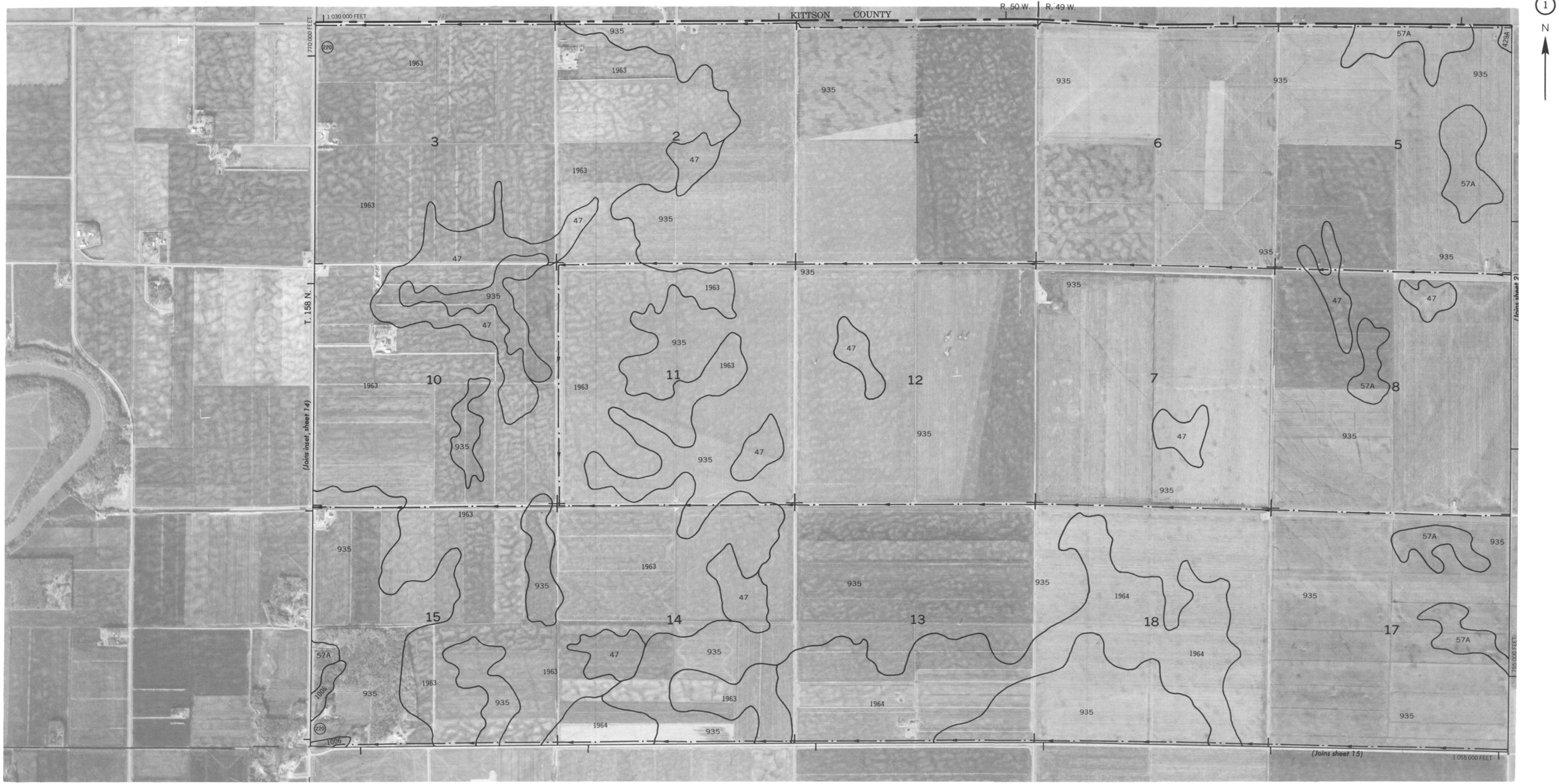
SHORT STEEP SLOPE . . . .

MISCELLANEOUS

- Gravelly spot ∴
- Dumps and other similar non soil areas ≡
- Sandy spot ⁘
- Very stony spot ∞
- Small area of organic soil ⌘
- Better drained soil in poorly drained areas ǂ

Areas represent .25 acre to 3 acres

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 1


KITTSON COUNTY
R. 50 W.
R. 49 W.
1 030 000 FEET
770 000 FEET
T. 158 N.
(Joins inset, sheet 14)
(Joins sheet 2)
(Joins sheet 15)
755 000 FEET
1 055 000 FEET
N
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14
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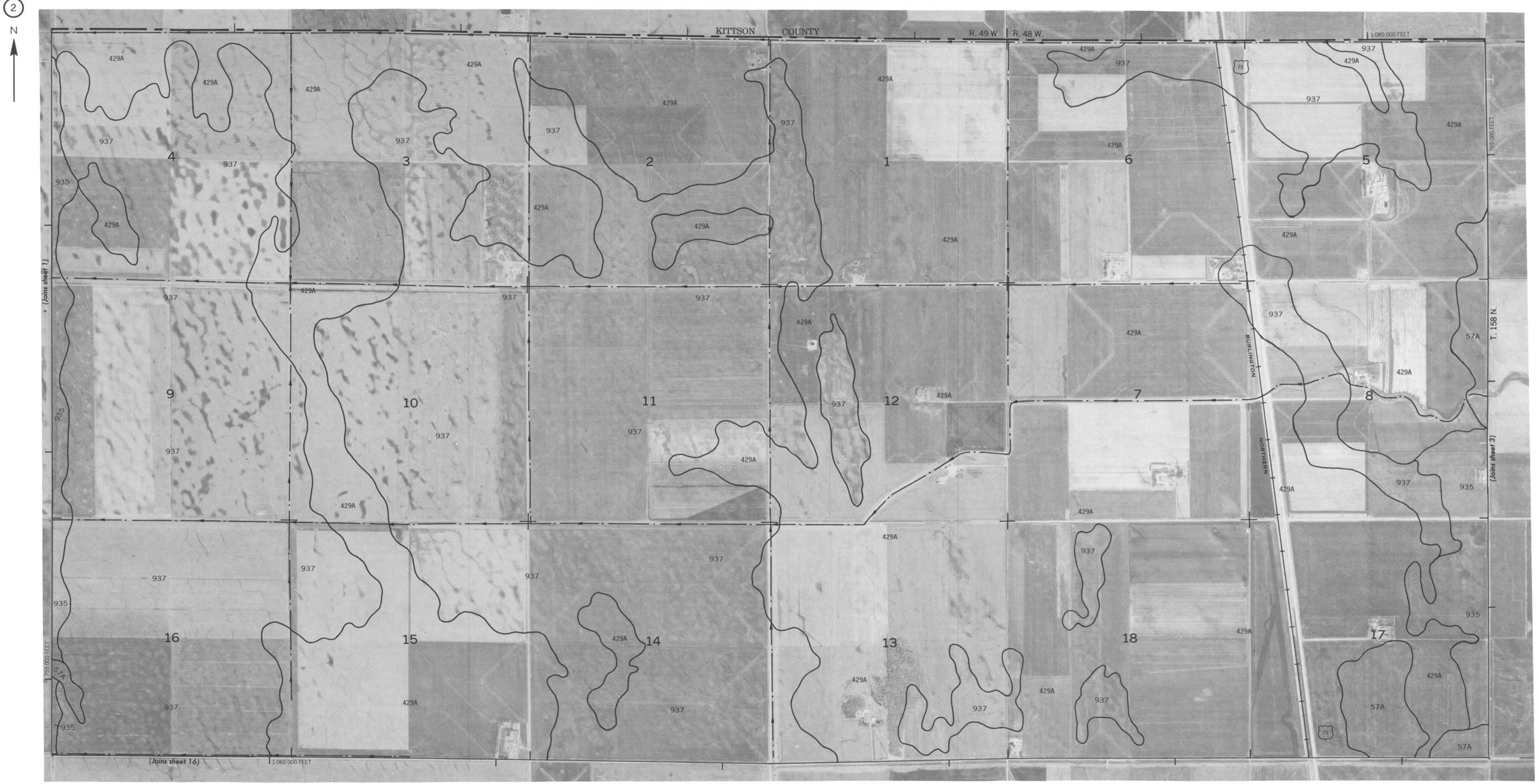
17
18
220
935
1963
1964
47
57A
429A
1006

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 2



②
N
KITTSON
COUNTY
R. 49 W.
R. 48 W.
1 085 000 FEET
765 000 FEET
T. 158 N.
(Joins sheet 3)
(Joins sheet 1)
(Joins sheet 16)
1 060 000 FEET
755 000 FEET
BURLINGTON
NORTHERN
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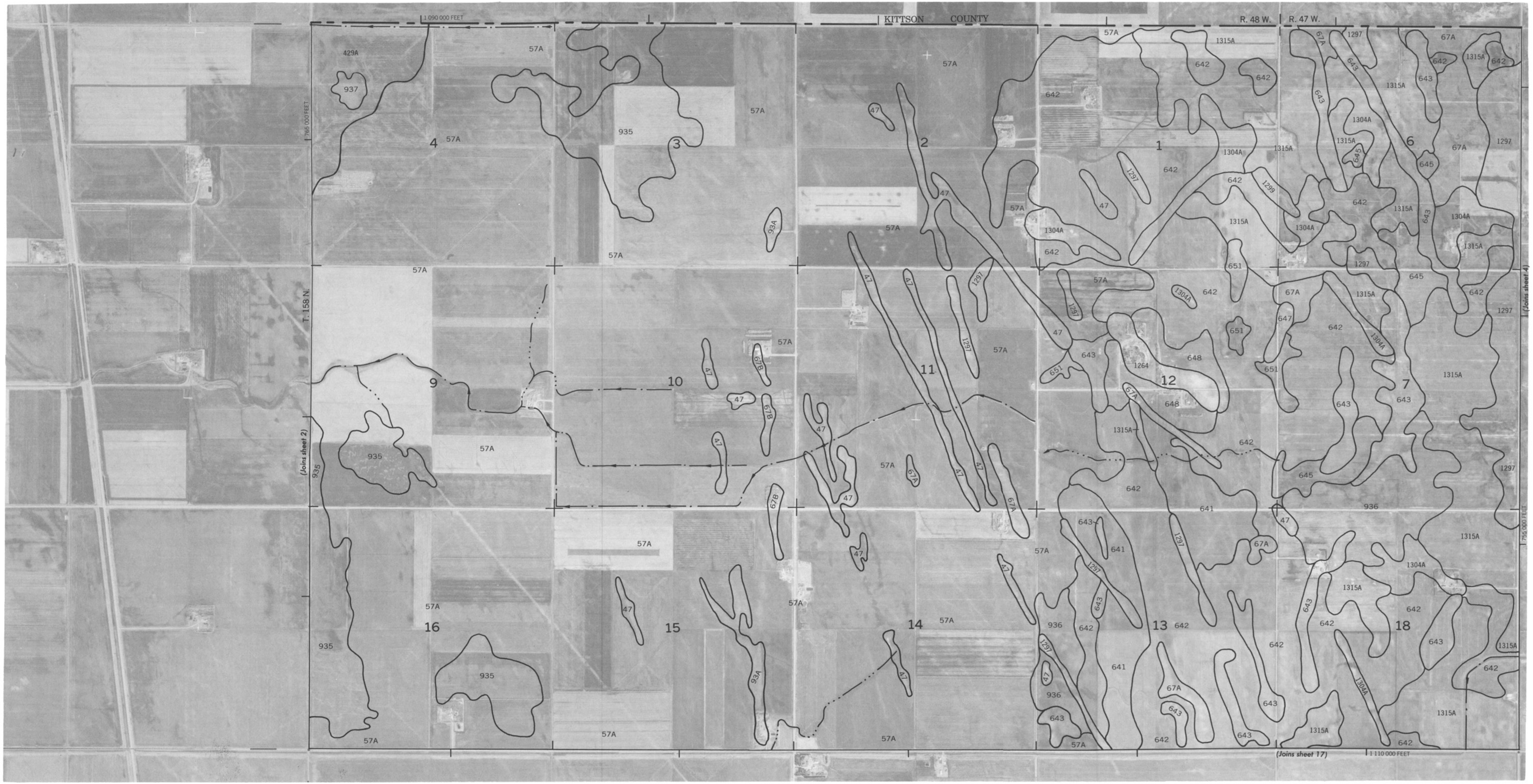
57A

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 3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KITTSON COUNTY
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R. 47 W.
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429A
937
57A
935
936
47
93A
67A
67B
642
643
641
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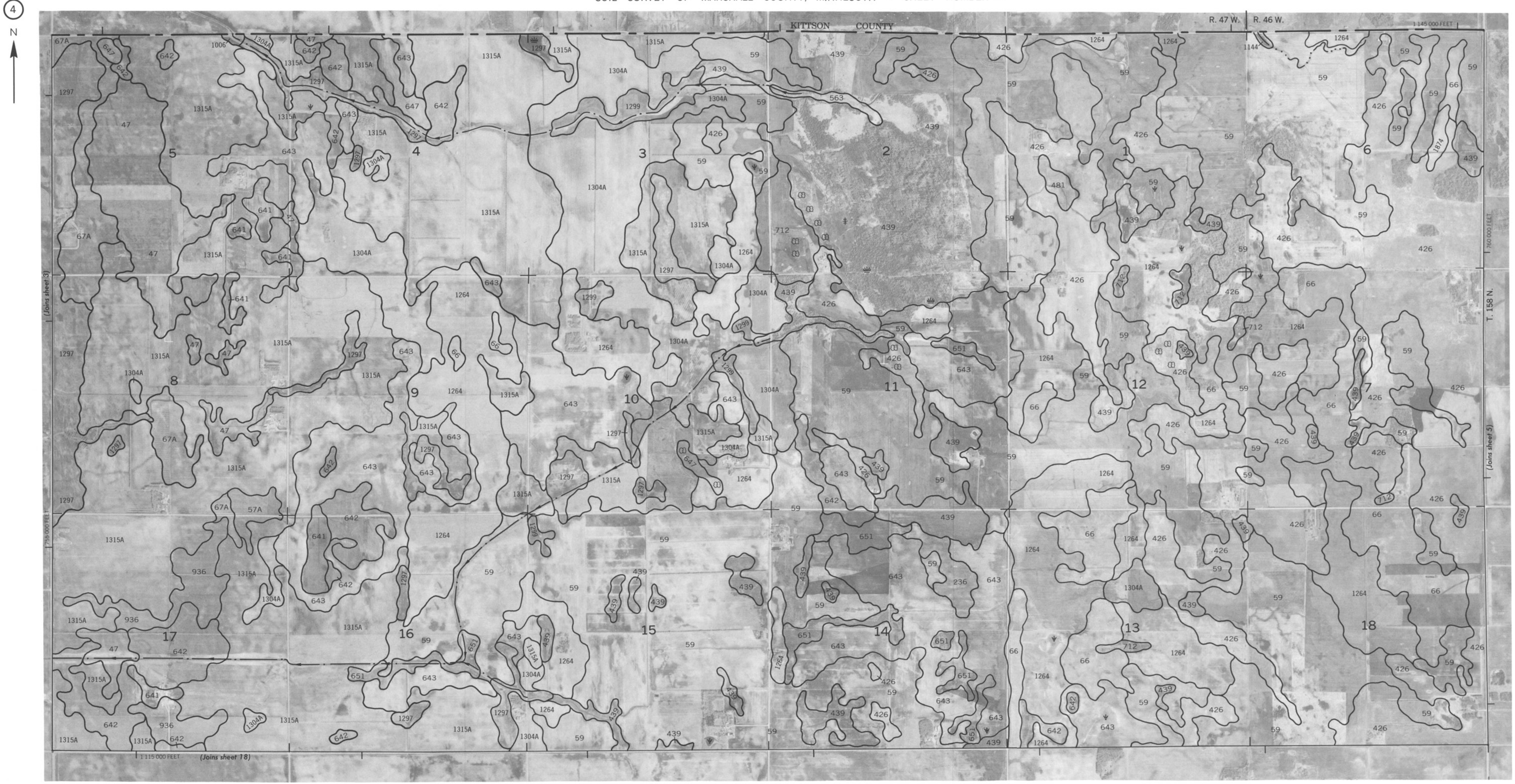
651
1264
1297
1299
1304A
1315A

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 4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N
KITTSON COUNTY
R. 47 W.
R. 46 W.
1 145 000 FEET
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T. 158 N.
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(Joins sheet 5)
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1 115 000 FEET
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SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 5

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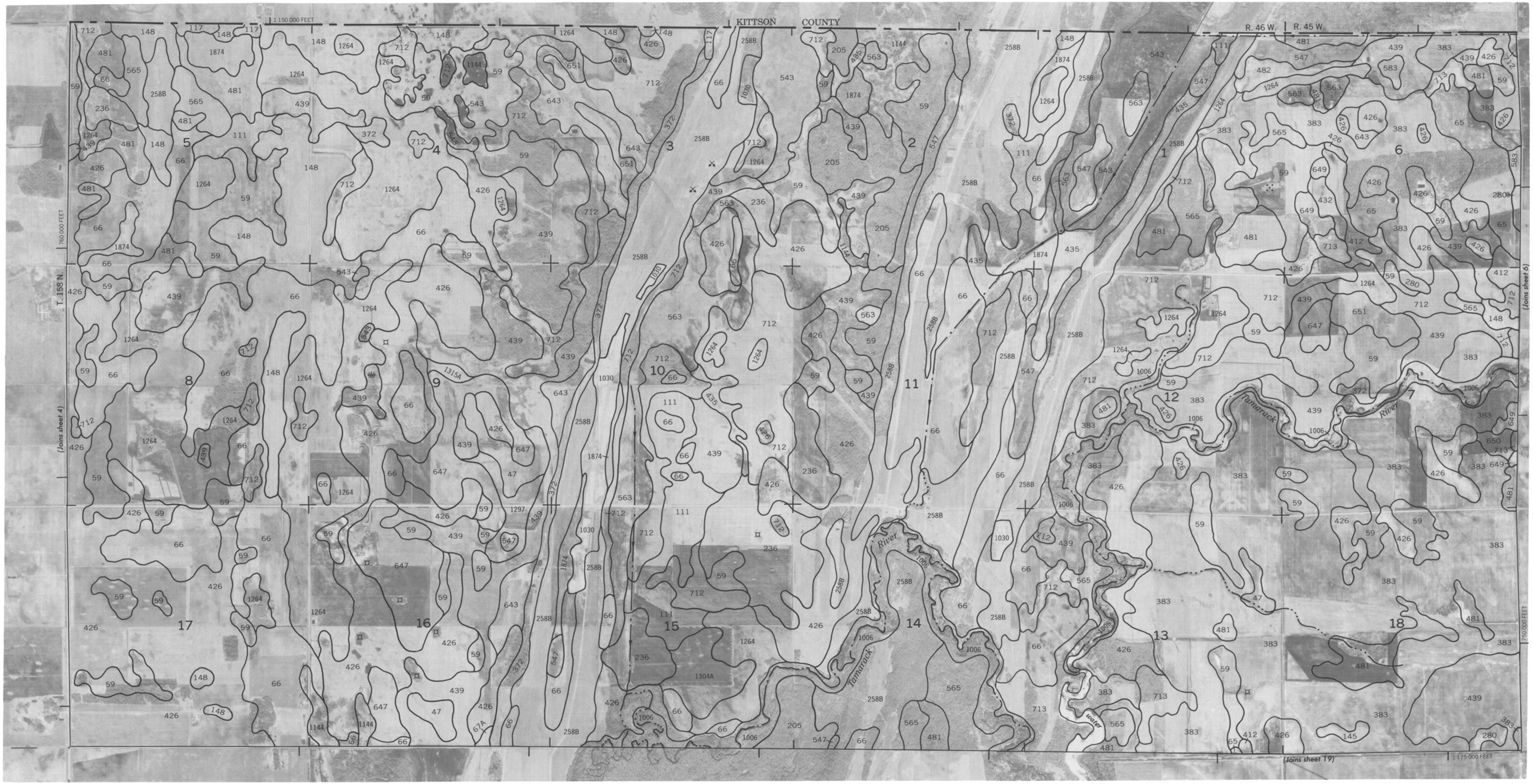

N
KITTSON COUNTY
1 150 000 FEET
R. 46 W.
R. 45 W.
750 000 FEET
T. 158 N.
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 19)
1 175 000 FEET
750 000 FEET
Tamarack River
River
Tamarack
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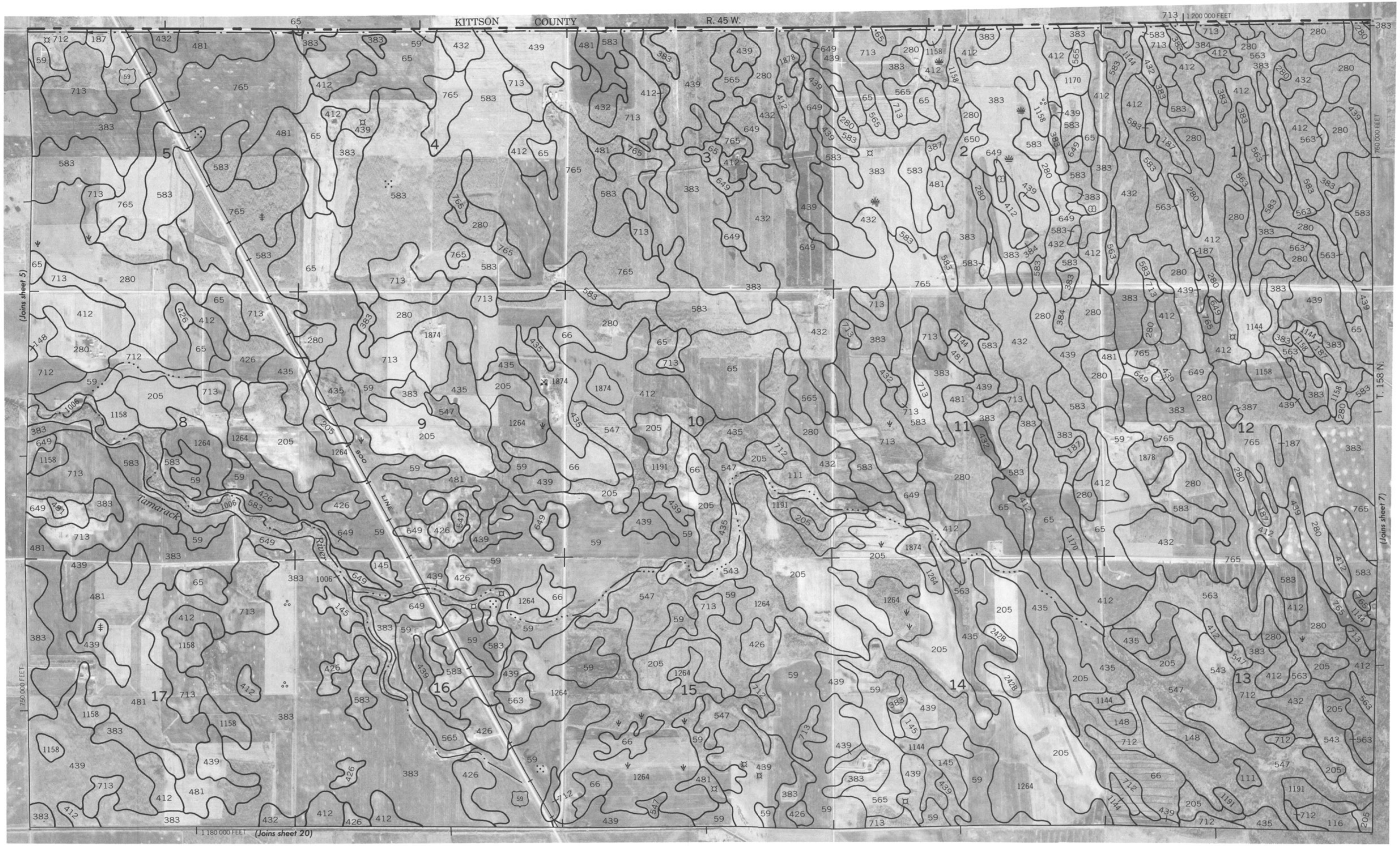
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 6


N
KITTSON COUNTY
R. 45 W.
1 200 000 FEET
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T. 158 N.
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(Joins sheet 7)
(Joins sheet 20)
750 000 FEET
1 180 000 FEET
Tamarack River
LINE
59
1
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SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 7

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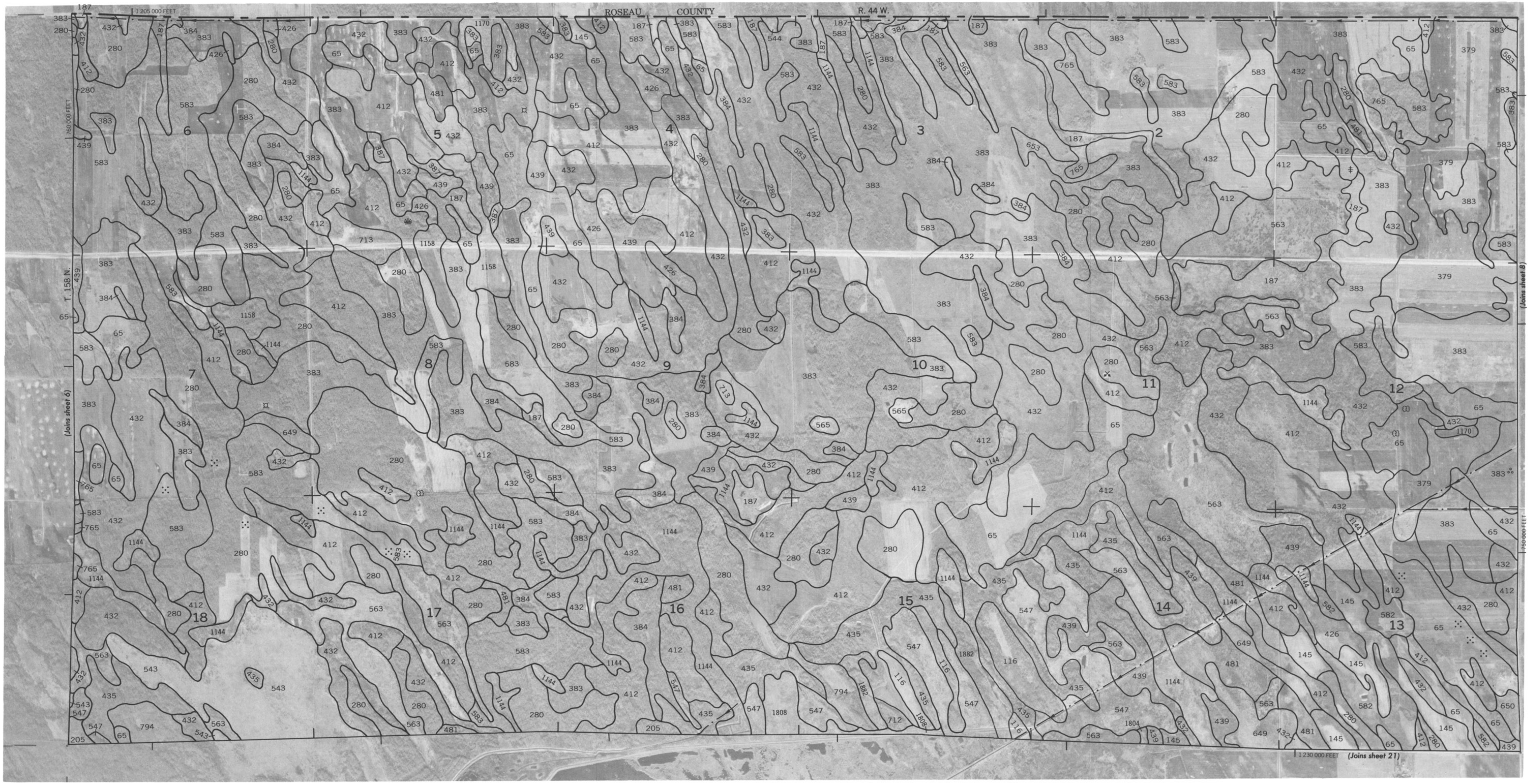

N
ROSEAU COUNTY
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(Joins sheet 8)
(Joins sheet 21)
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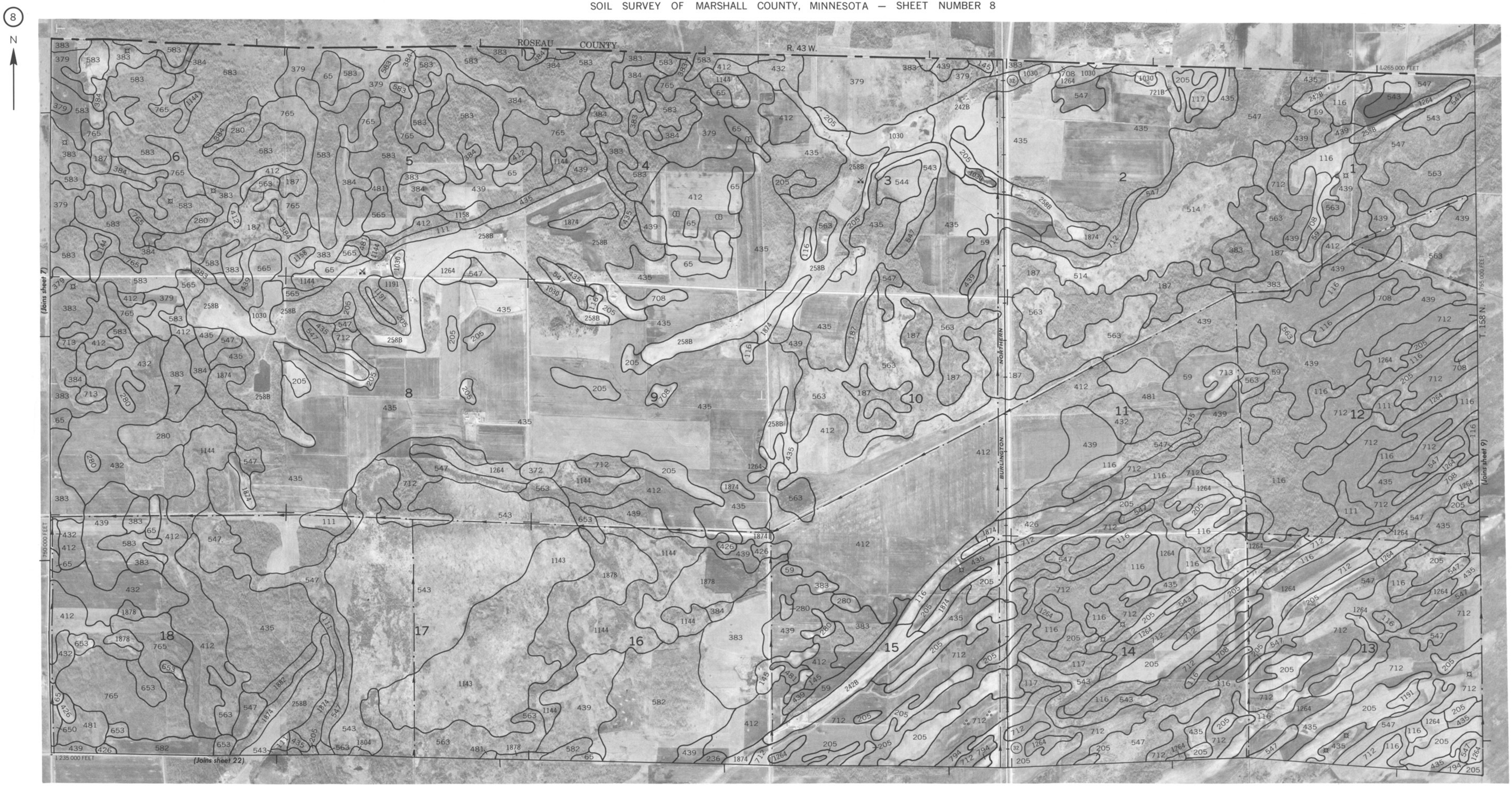
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 8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750 000 FEET
755 000 FEET
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(Joins sheet 9)
(Joins sheet 22)
NORTHERN
BURLINGTON
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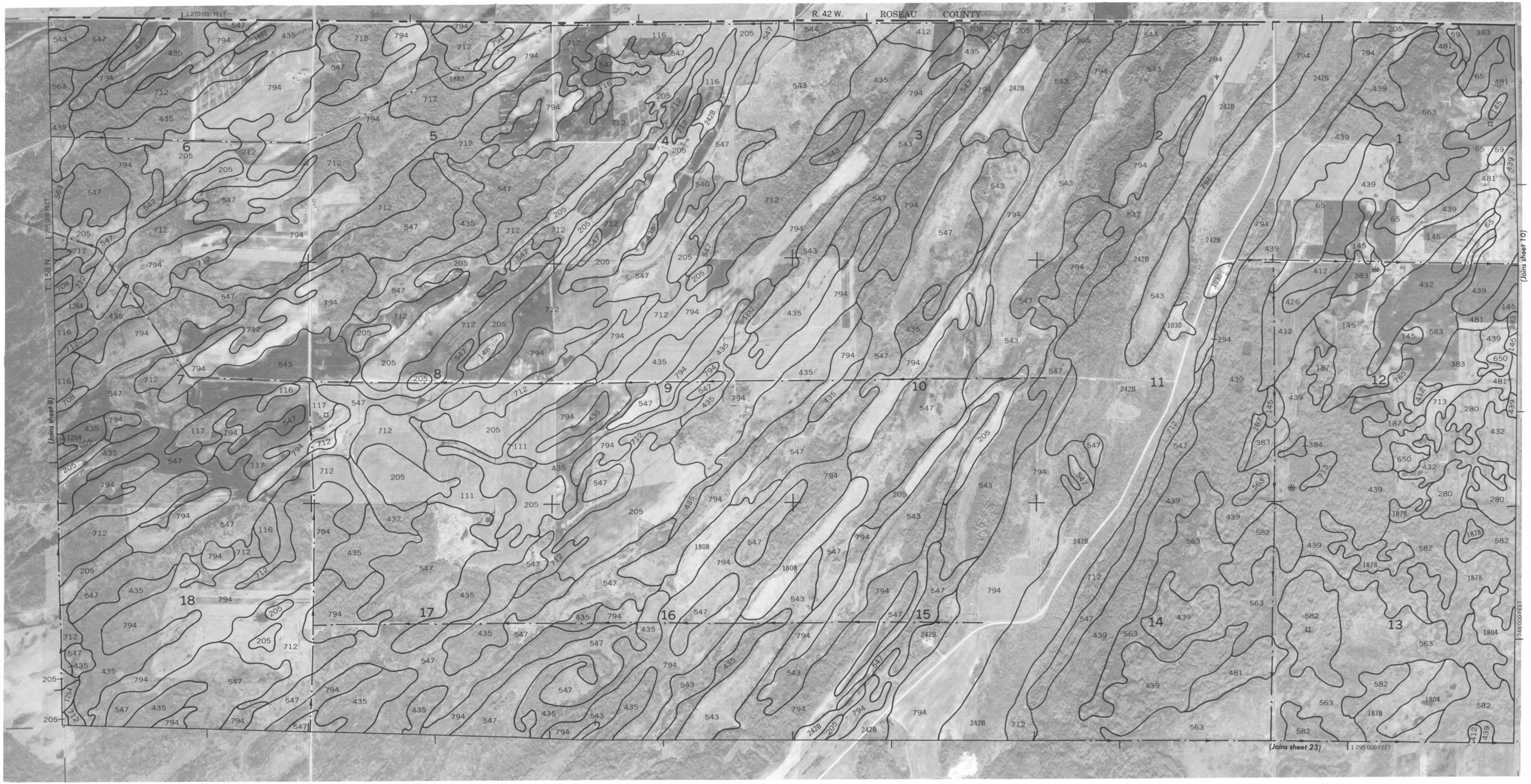
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 9


N
R. 42 W.
ROSEAU COUNTY
1 270 000 FEET
T. 158 N.
795 000 FEET
(Joins sheet 8)
(Joins sheet 10)
745 000 FEET
(Joins sheet 23)
1 295 000 FEET
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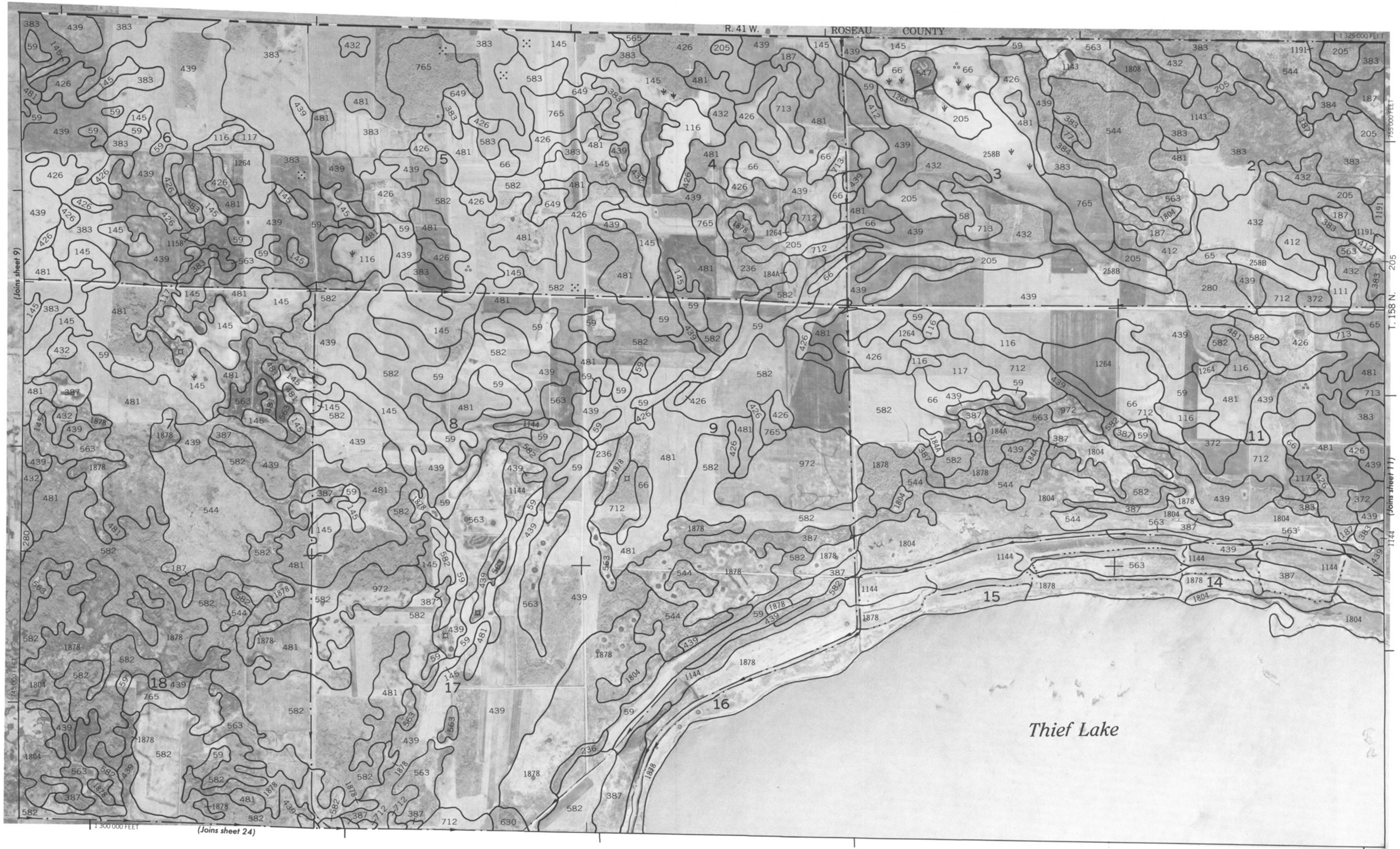
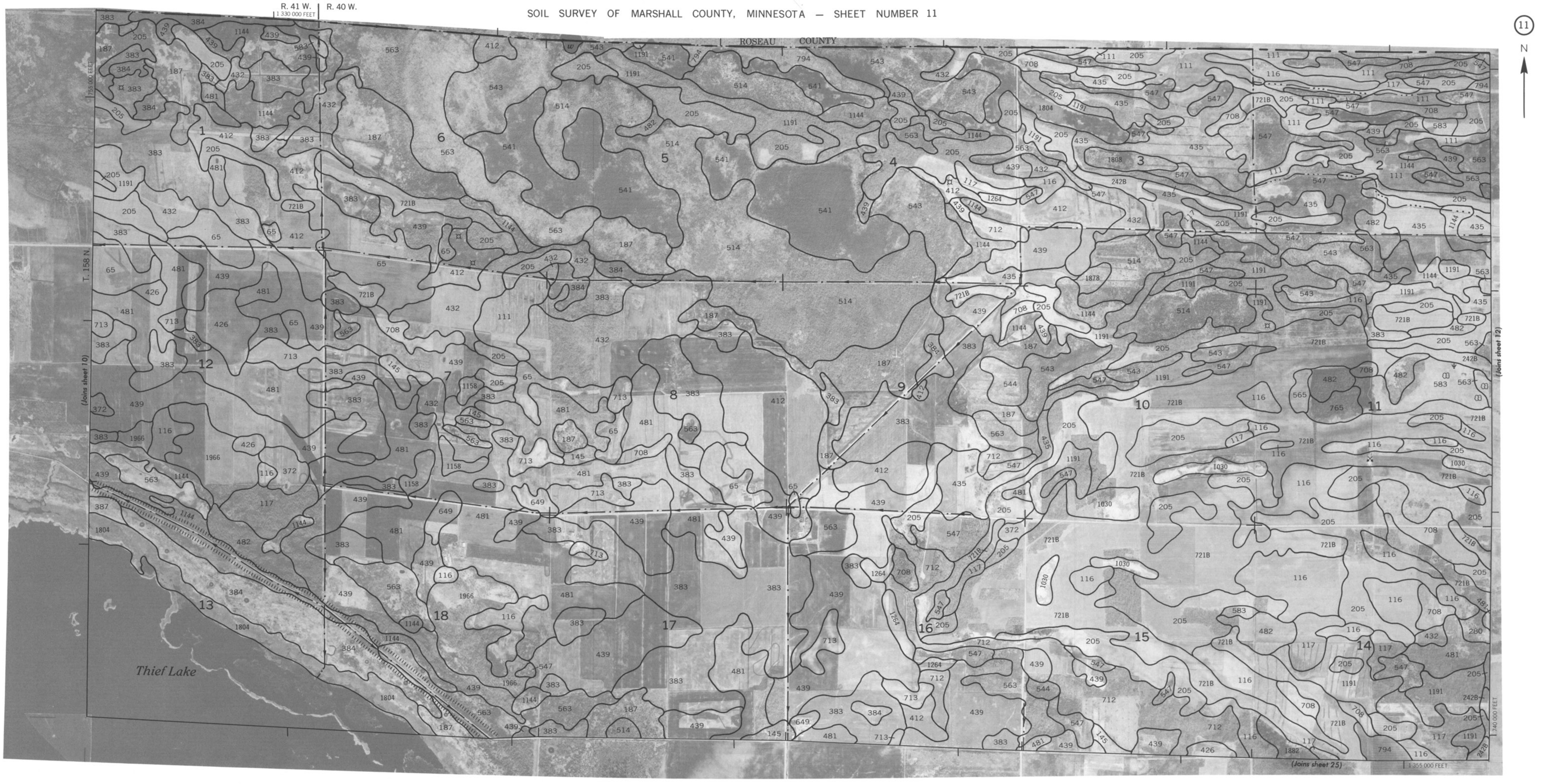
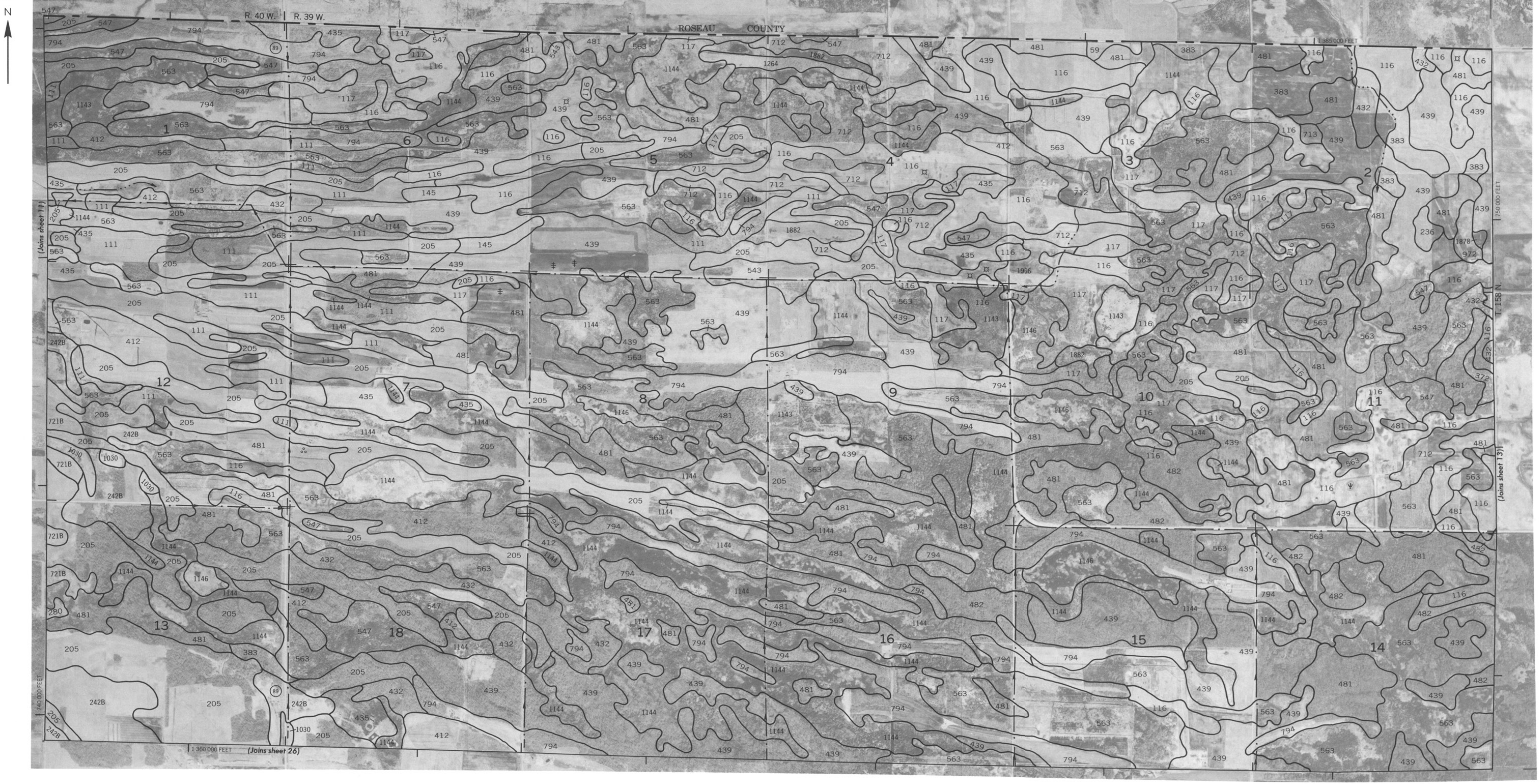

R. 41 W.
ROSEAU COUNTY
1 325 000 FEET
755 000 FEET
T. 158 N.
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 24)
1 300 000 FEET
745 000 FEET
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18
Thief Lake

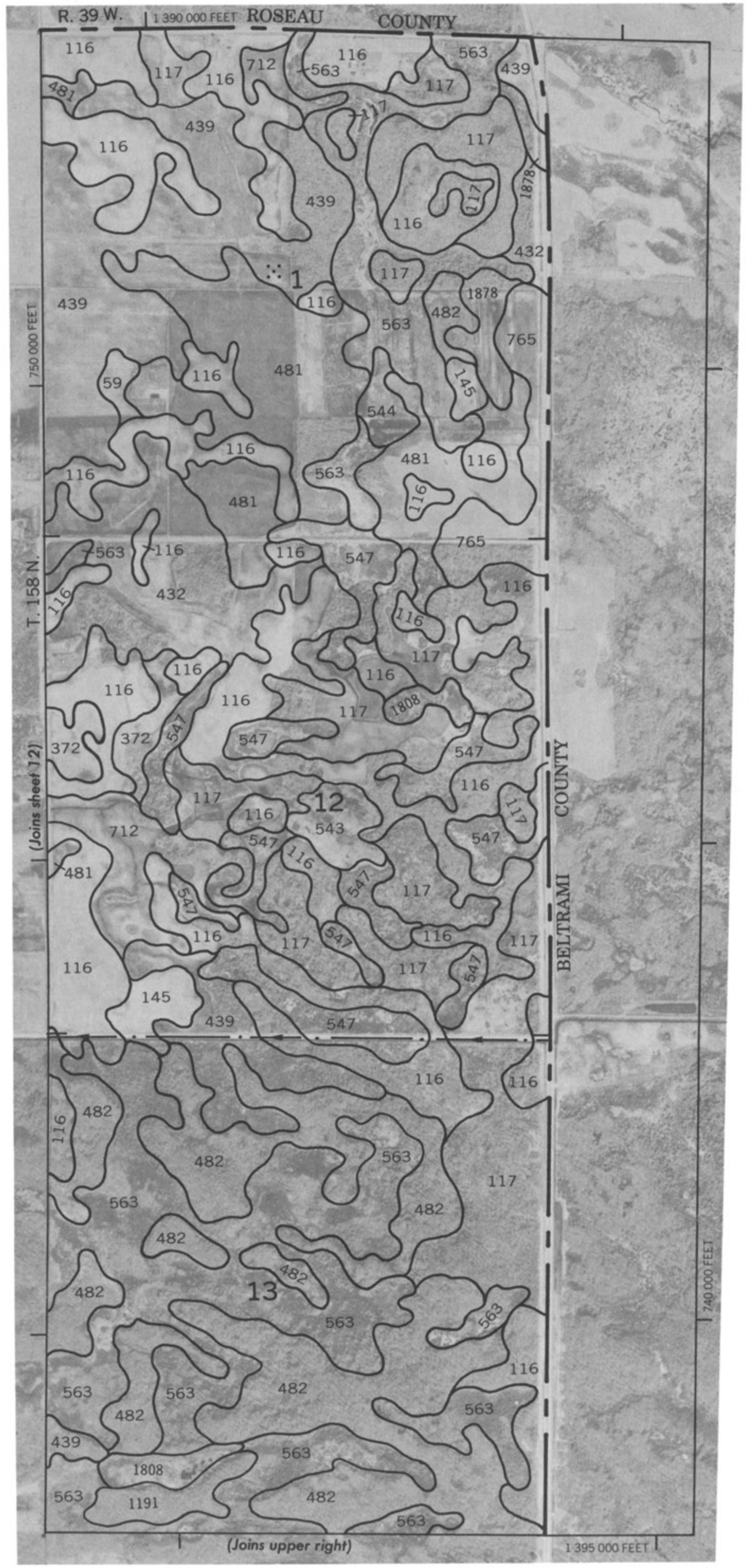
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 11

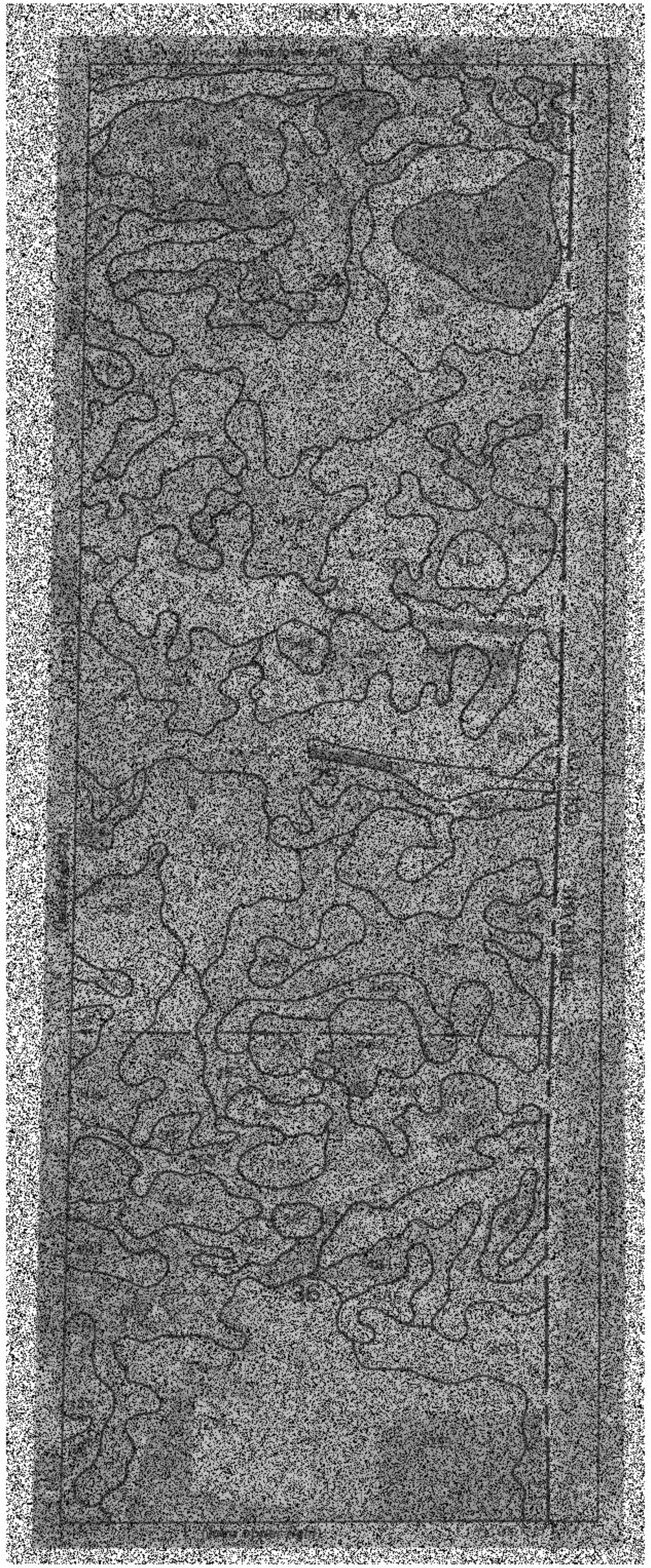

R. 41 W.
R. 40 W.
1 330 000 FEET
ROSEAU COUNTY
11
N
755 000 FEET
T. 158 N.
(Joins sheet 10)
(Joins sheet 12)
Thief Lake
(Joins sheet 25)
740 000 FEET
1 355 000 FEET

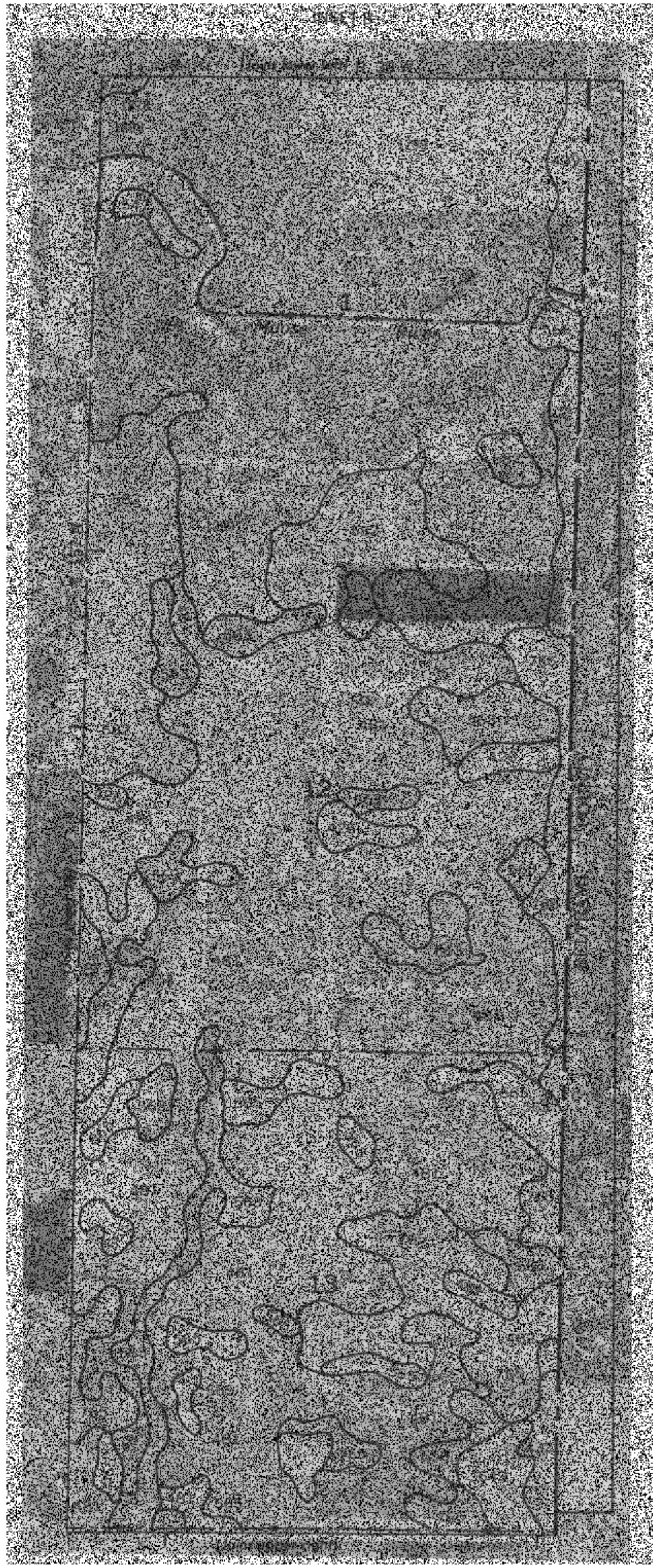
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 12

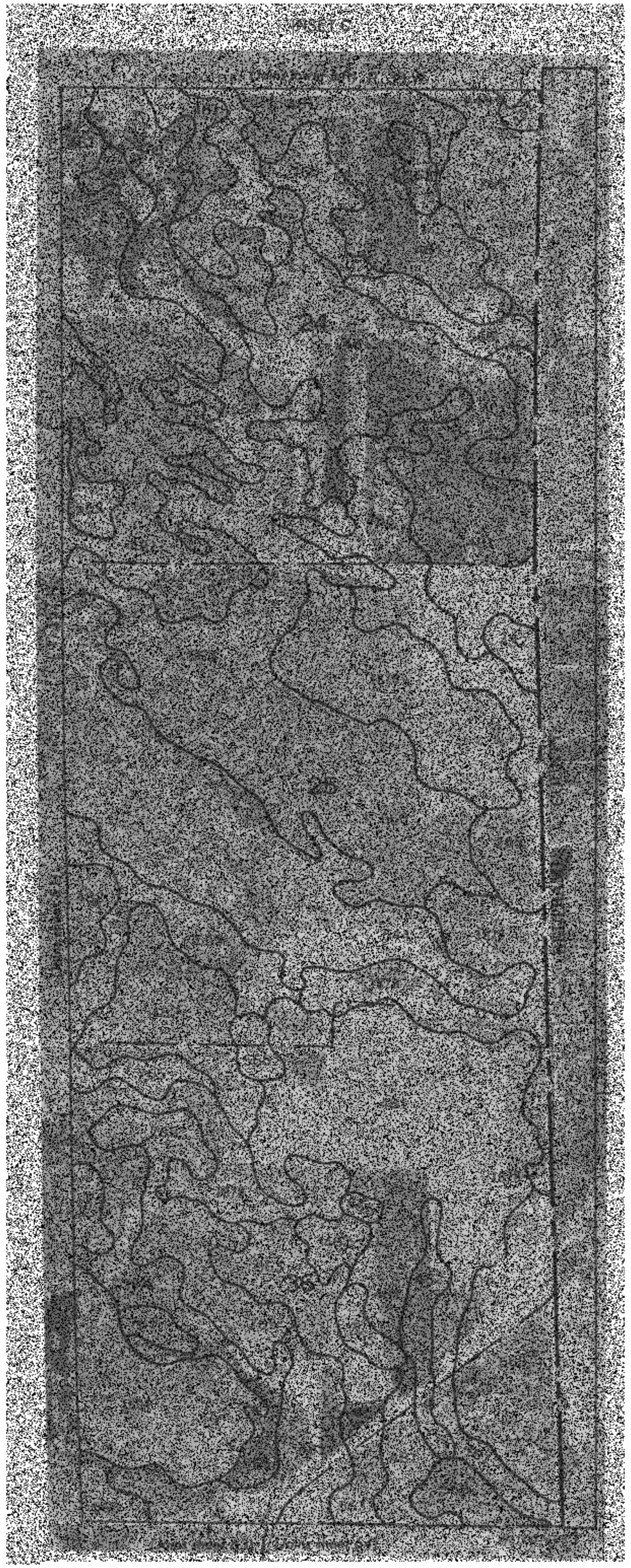

N
R. 40 W.
R. 39 W.
ROSEAU COUNTY
1 365 000 FEET
750 000 FEET
T. 158 N.
(Joins sheet 13)
(Joins sheet 11)
(Joins sheet 26)
1 360 000 FEET
740 000 FEET
89
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

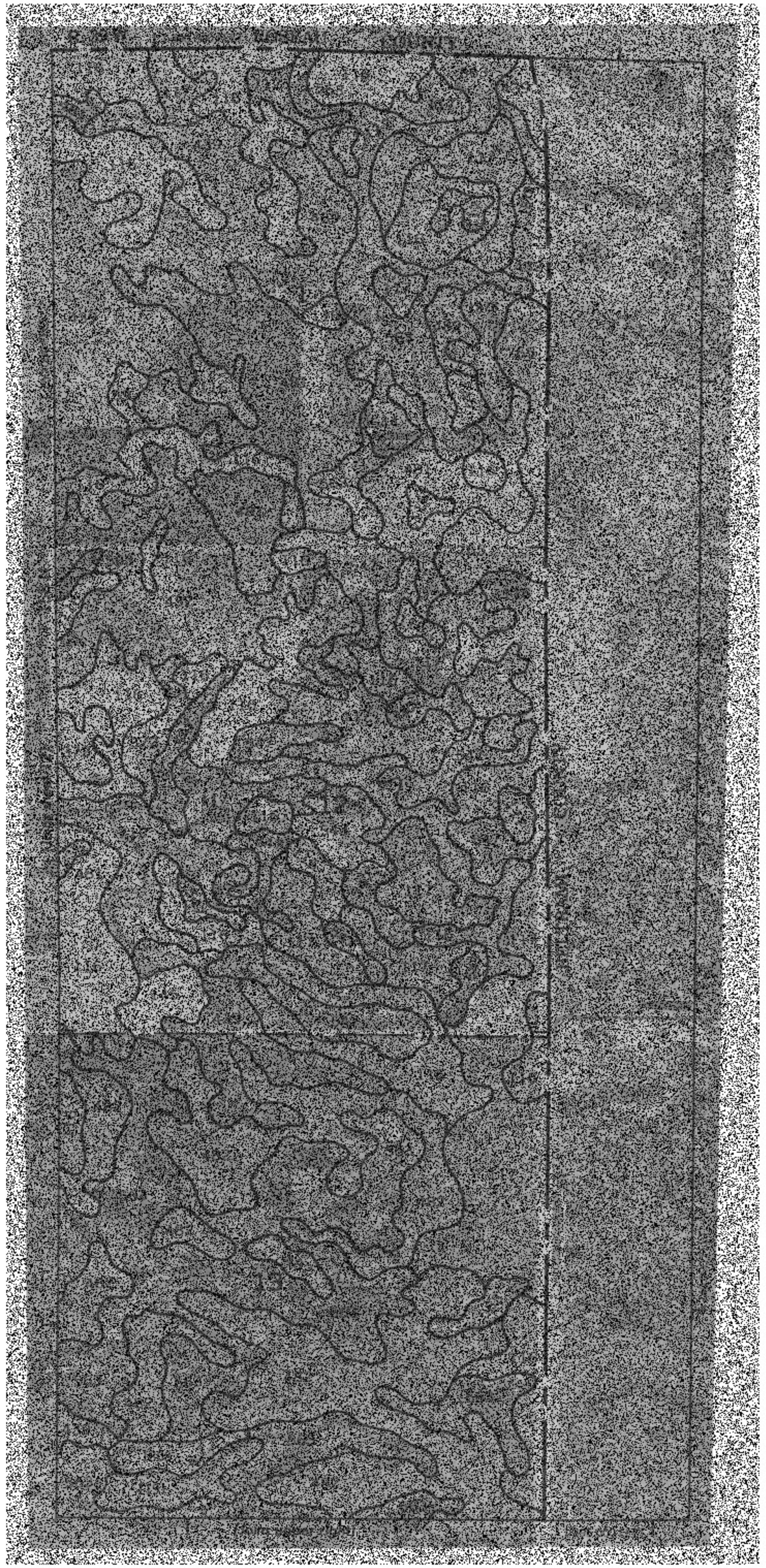
N


R. 39 W.
1 390 000 FEET
ROSEAU COUNTY
BELTRAMI COUNTY
T. 158 N.
750 000 FEET
740 000 FEET
(Joins sheet 12)
(Joins upper right)
1 395 000 FEET
1
12
13
116
117
439
481
482
563
712
432
1878
765
145
544
59
547
1808
372
543
1191

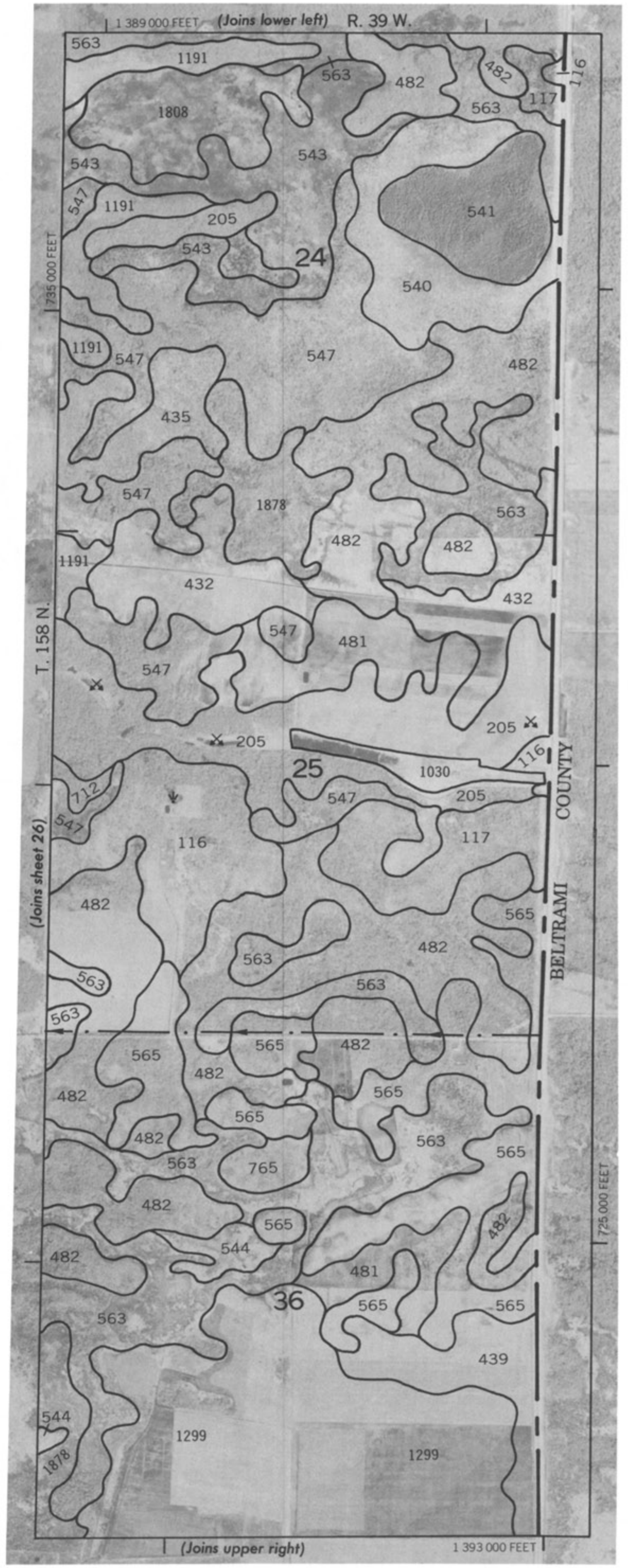


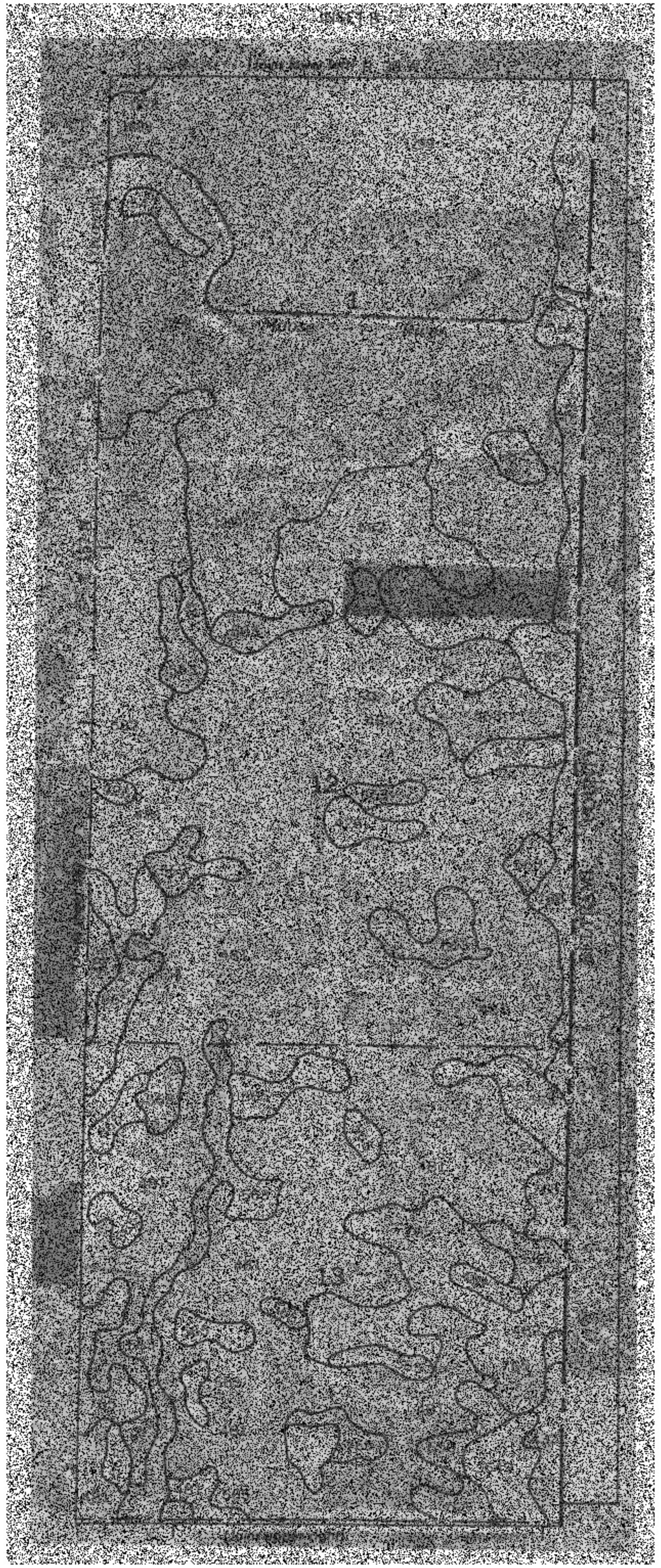


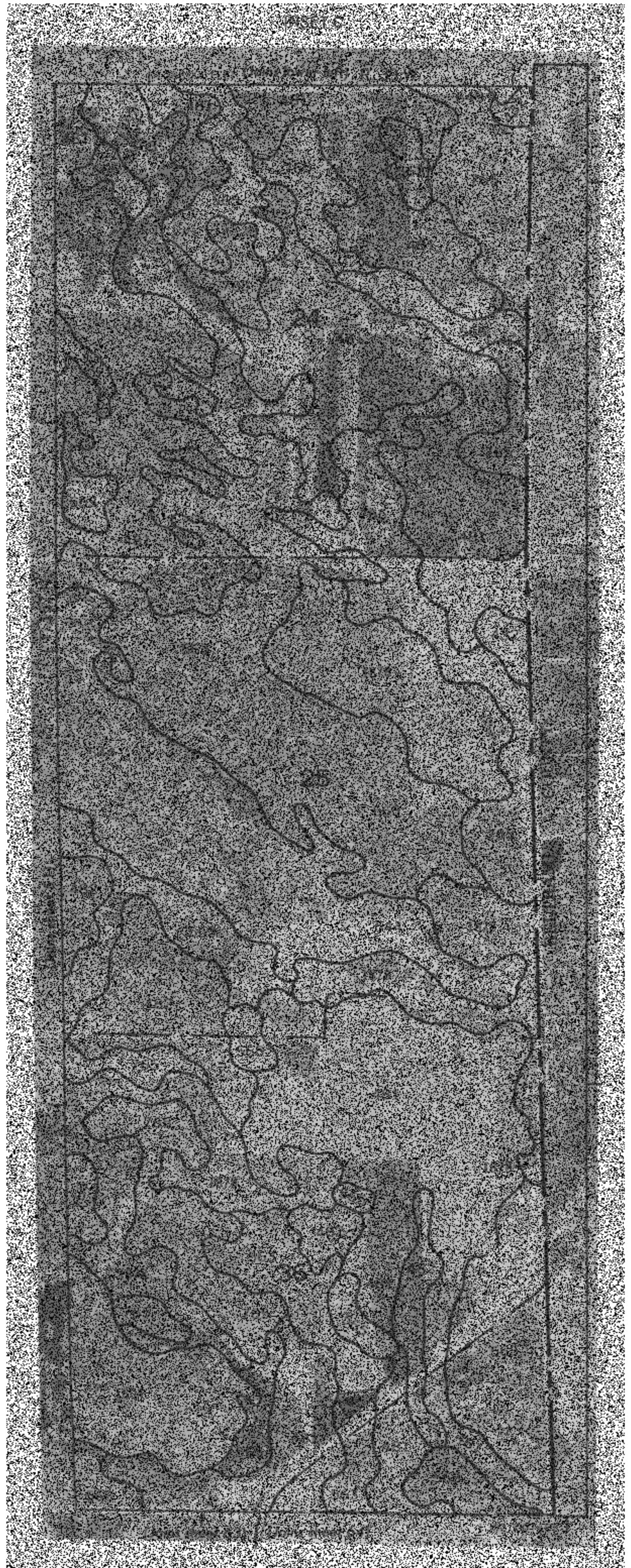


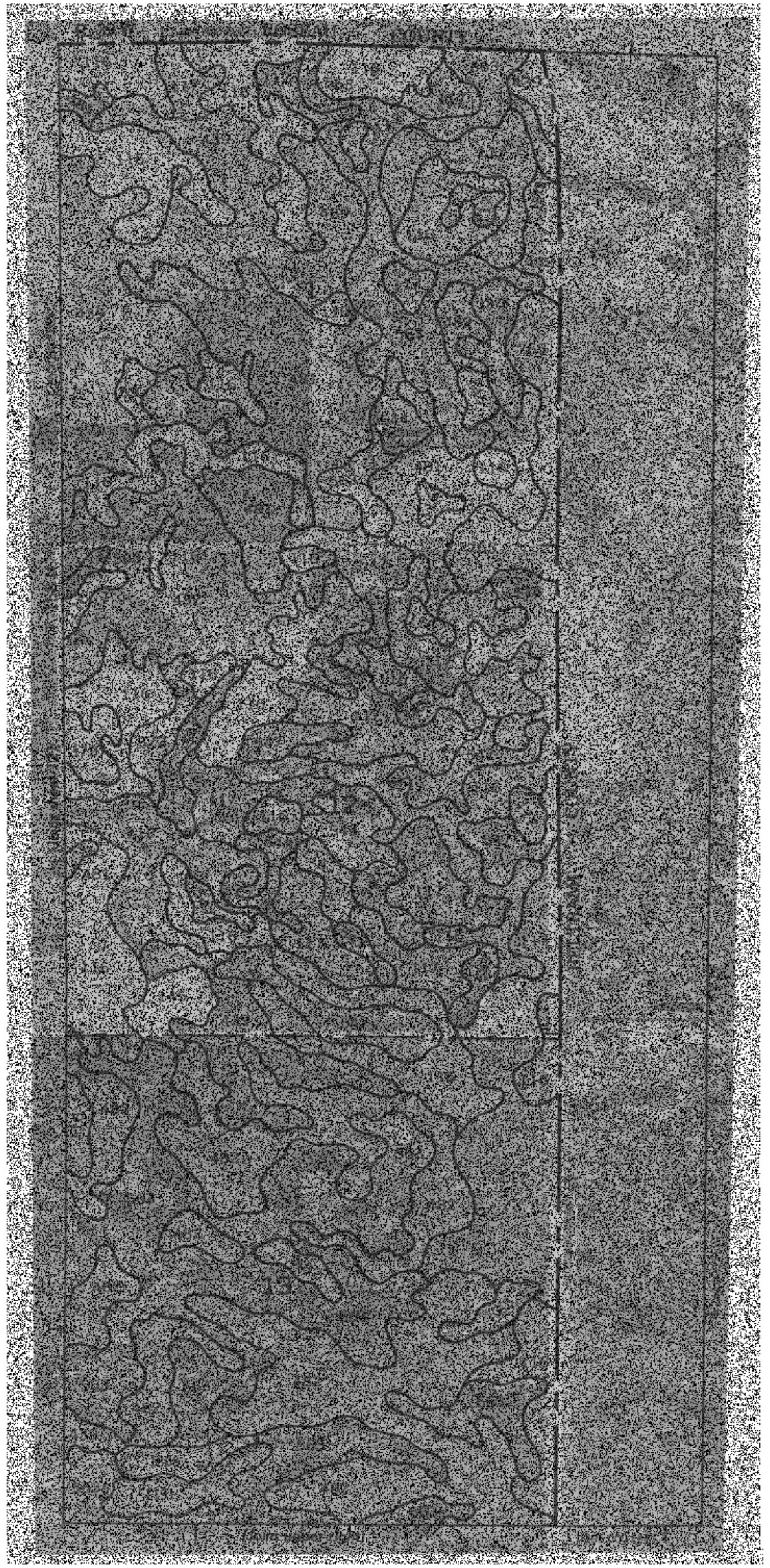


INSET A

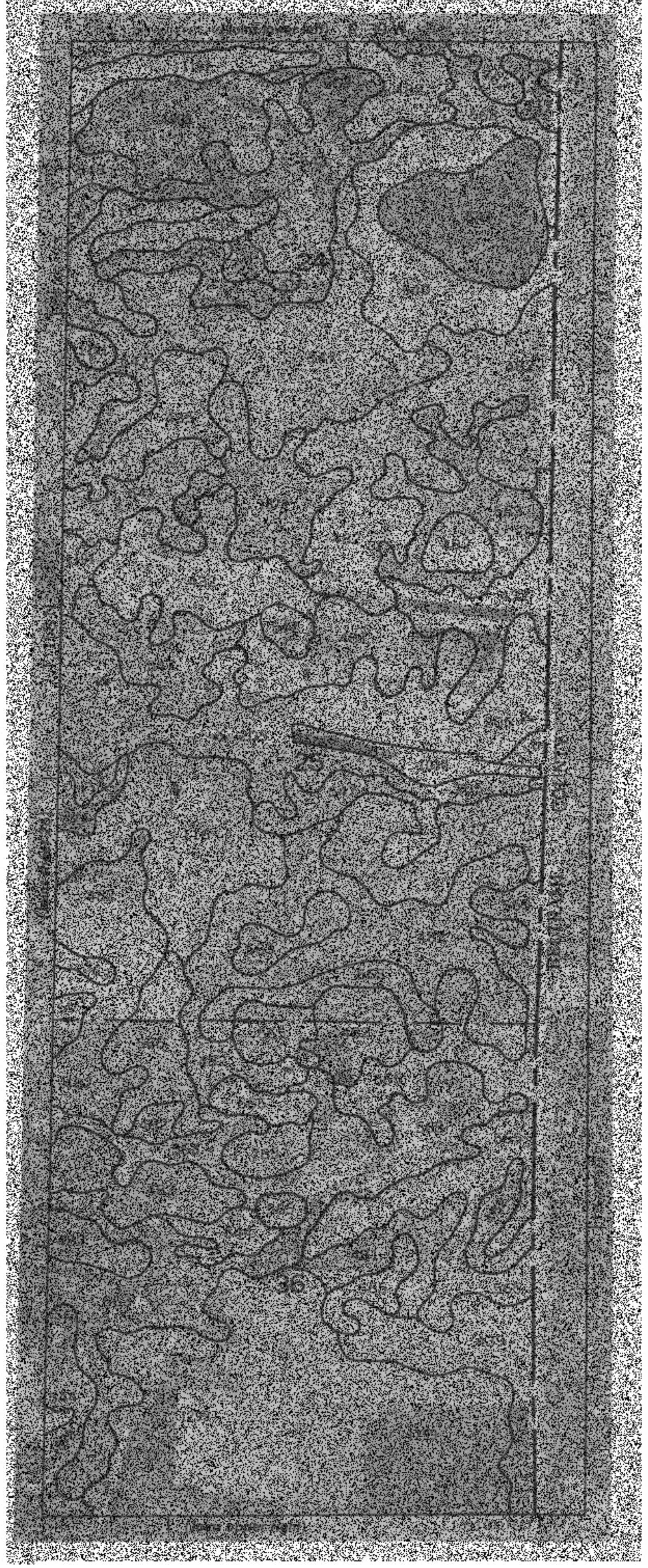

1 389 000 FEET
(Joins lower left)
R. 39 W.
563
1191
563
482
482
117
116
1808
563
543
543
547
1191
205
541
543
24
540
735 000 FEET
1191
547
547
482
435
547
1878
563
482
482
1191
432
432
T. 158 N.
547
481
547
205
205
25
1030
116
COUNTY
712
547
205
116
117
(Joins sheet 26)
482
565
563
482
563
563
BELTRAMI
565
482
482
565
482
565
765
563
565
482
482
565
482
544
481
36
565
565
563
439
725 000 FEET
544
1299
1878
1299
(Joins upper right)
1 393 000 FEET



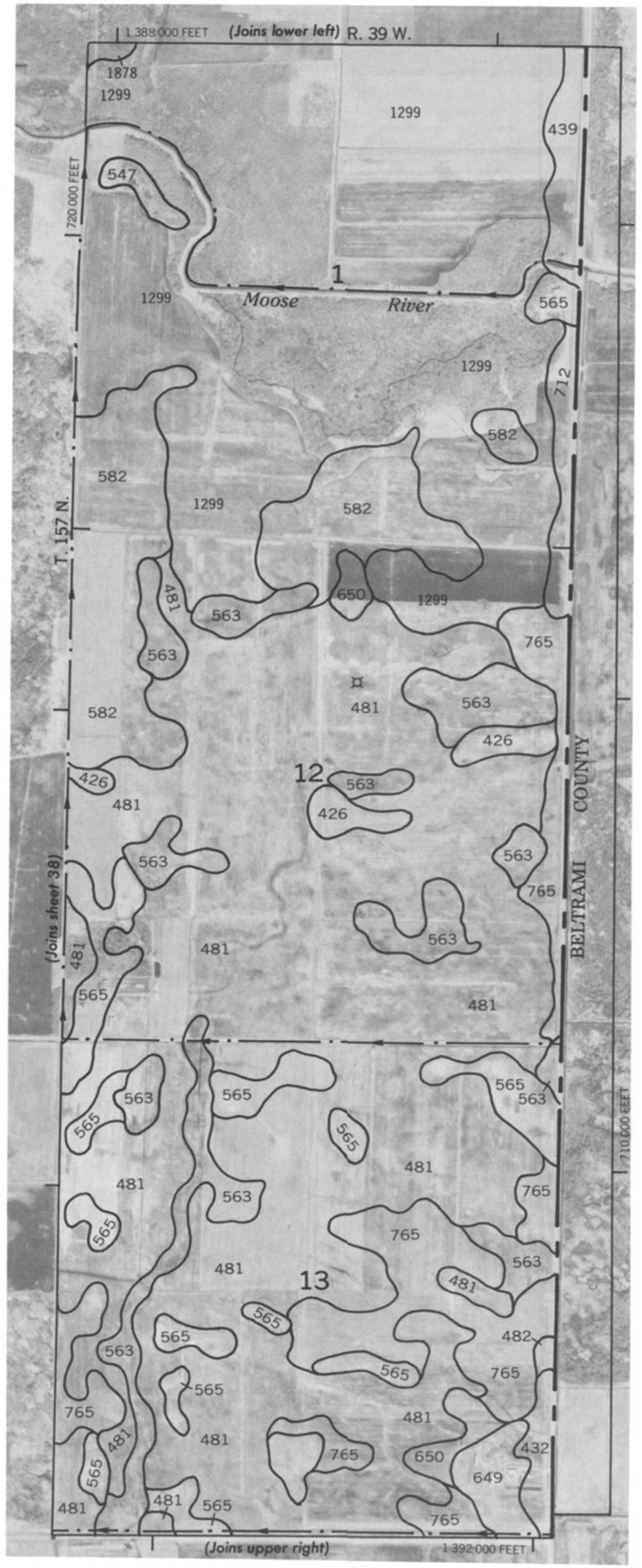


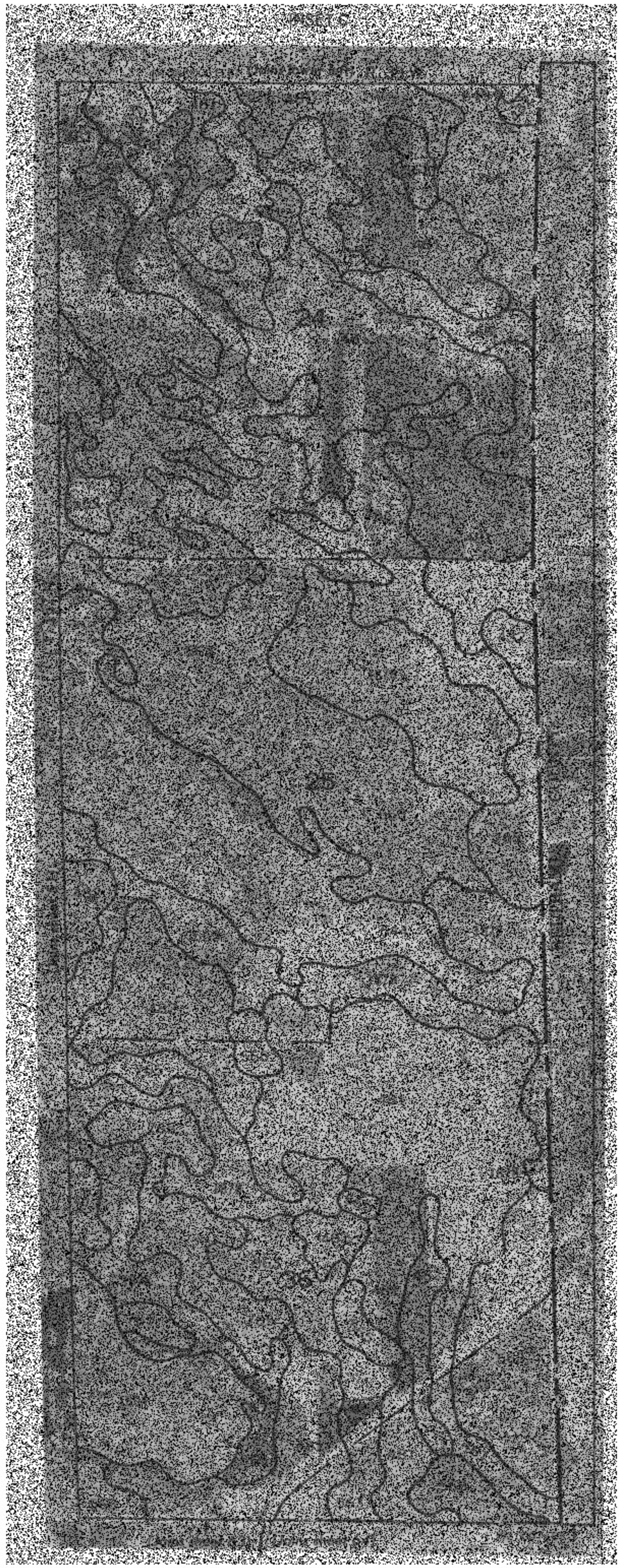


INSET A

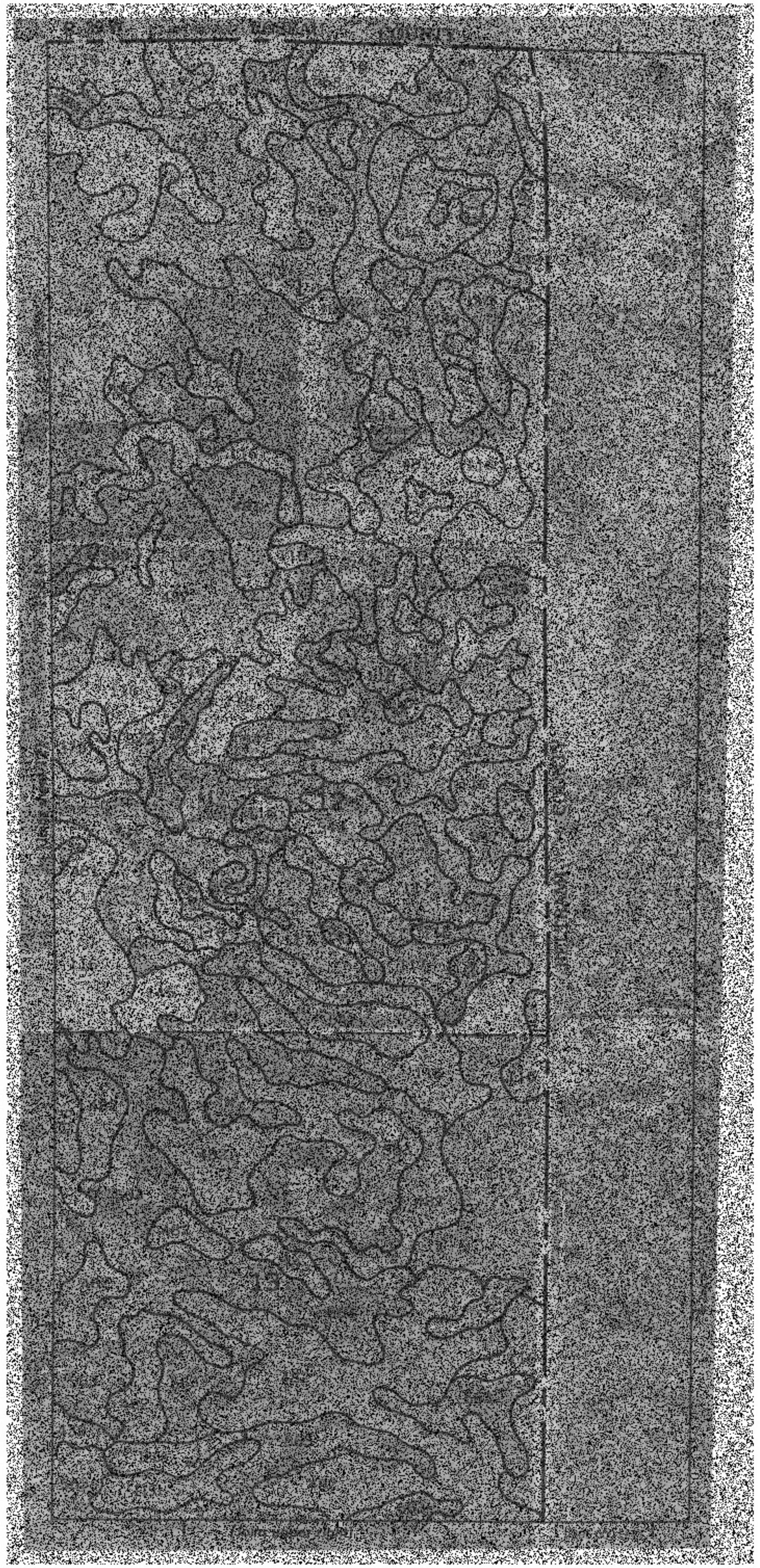


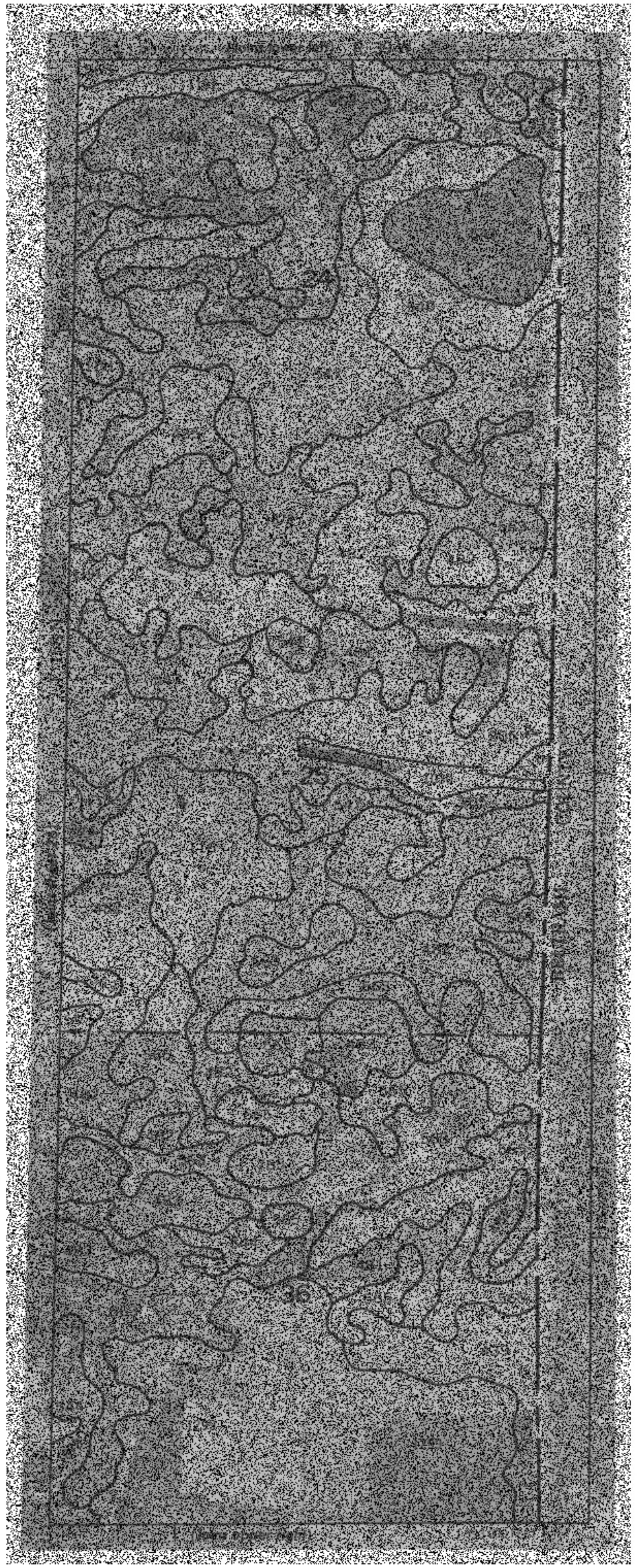
INSET B

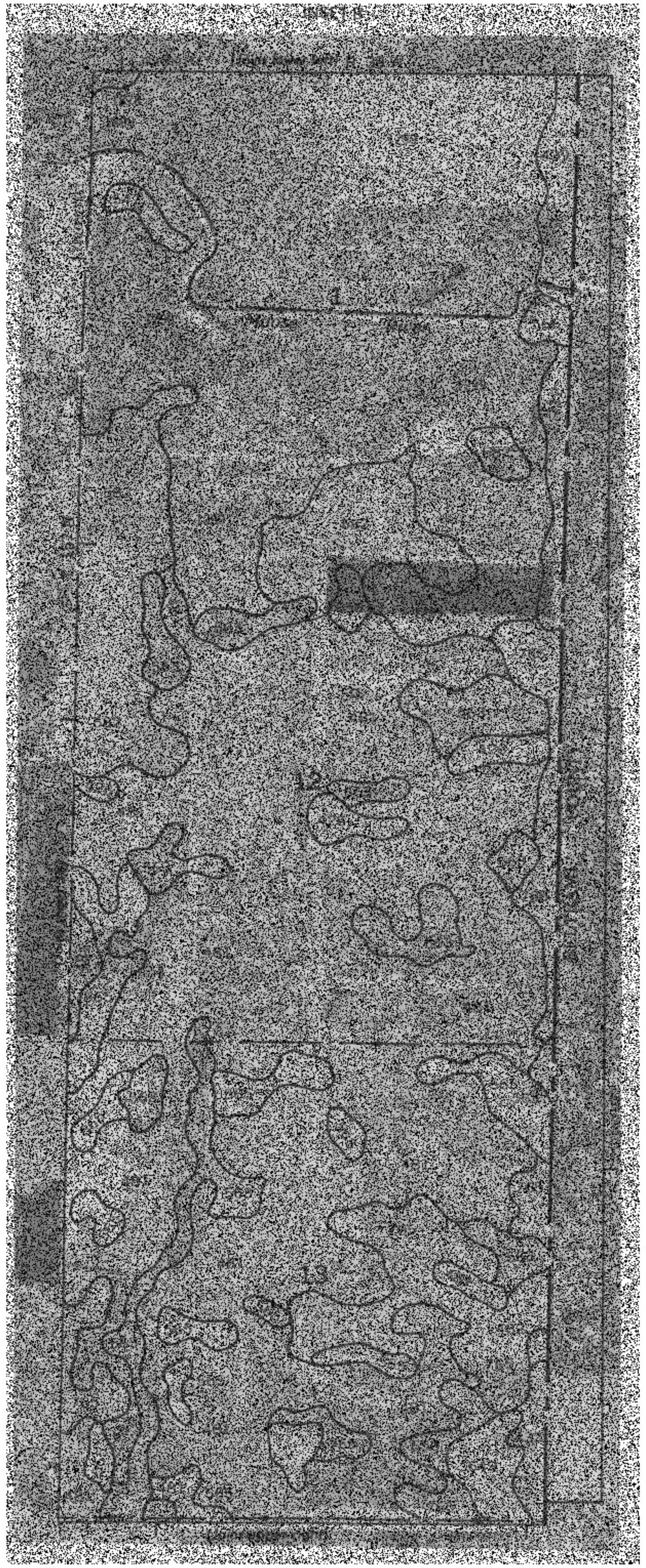

1 388 000 FEET
(Joins lower left)
R. 39 W.
1878
1299
439
547
720 000 FEET
1
Moose
River
565
712
582
T. 157 N.
481
563
650
765
426
12
(Joins sheet 38)
13
482
432
649
BELTRAMI COUNTY
710 000 FEET
(Joins upper right)
1 392 000 FEET



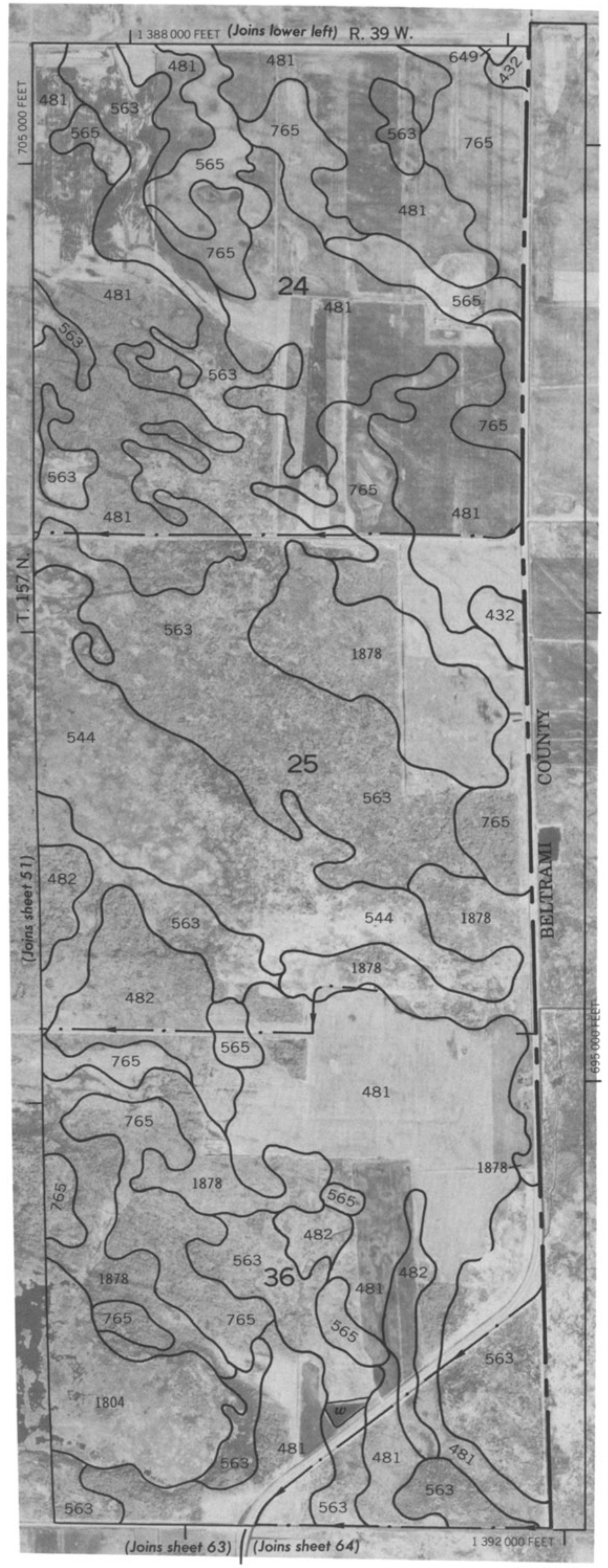
N







INSET C


N
1 388 000 FEET
(Joins lower left)
R. 39 W.
705 000 FEET
T. 157 N.
(Joins sheet 51)
BELTRAMI COUNTY
1 392 000 FEET
(Joins sheet 63)
(Joins sheet 64)
24
25
36
481
563
565
765
649
432
1878
544
482
1804

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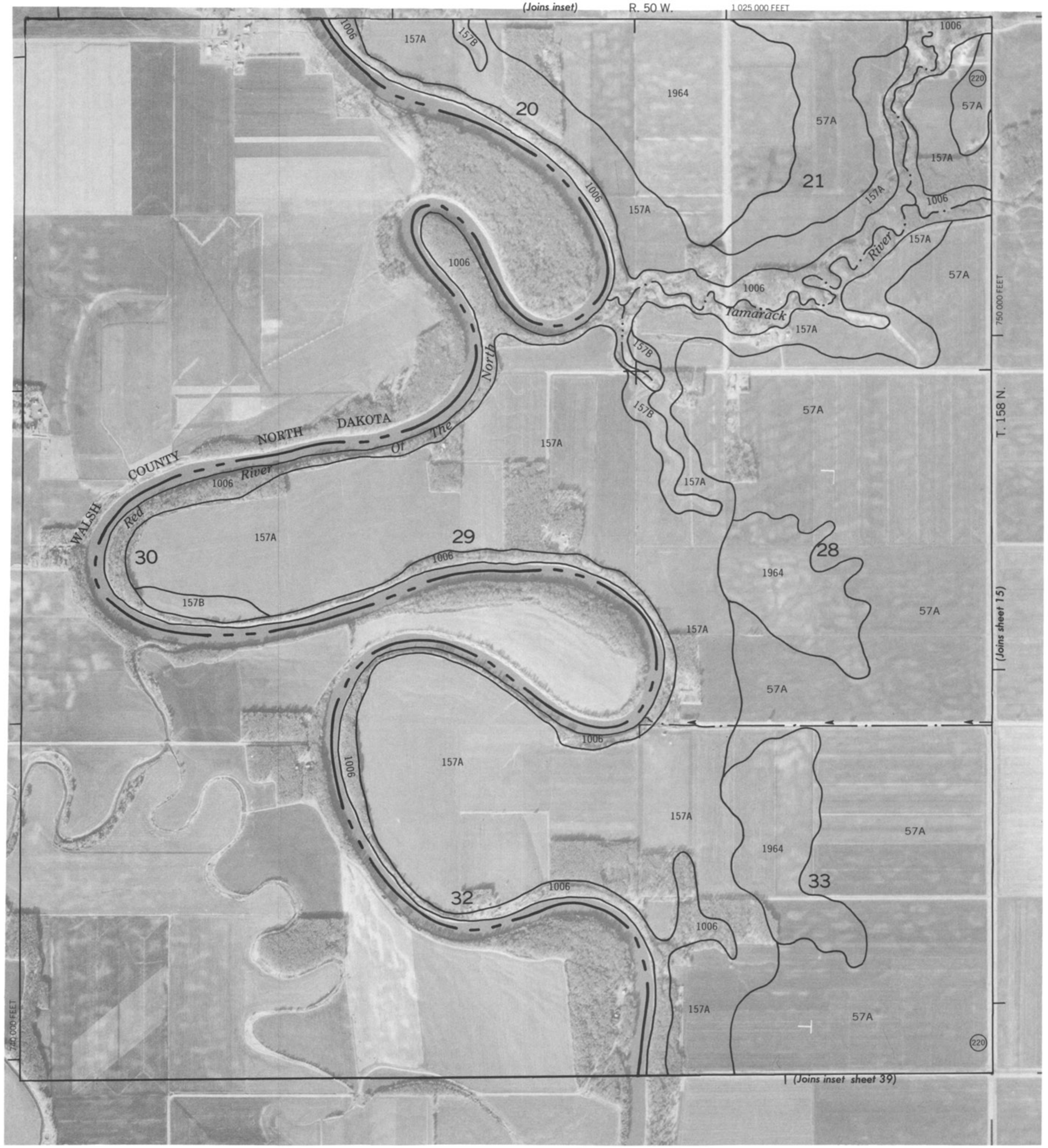
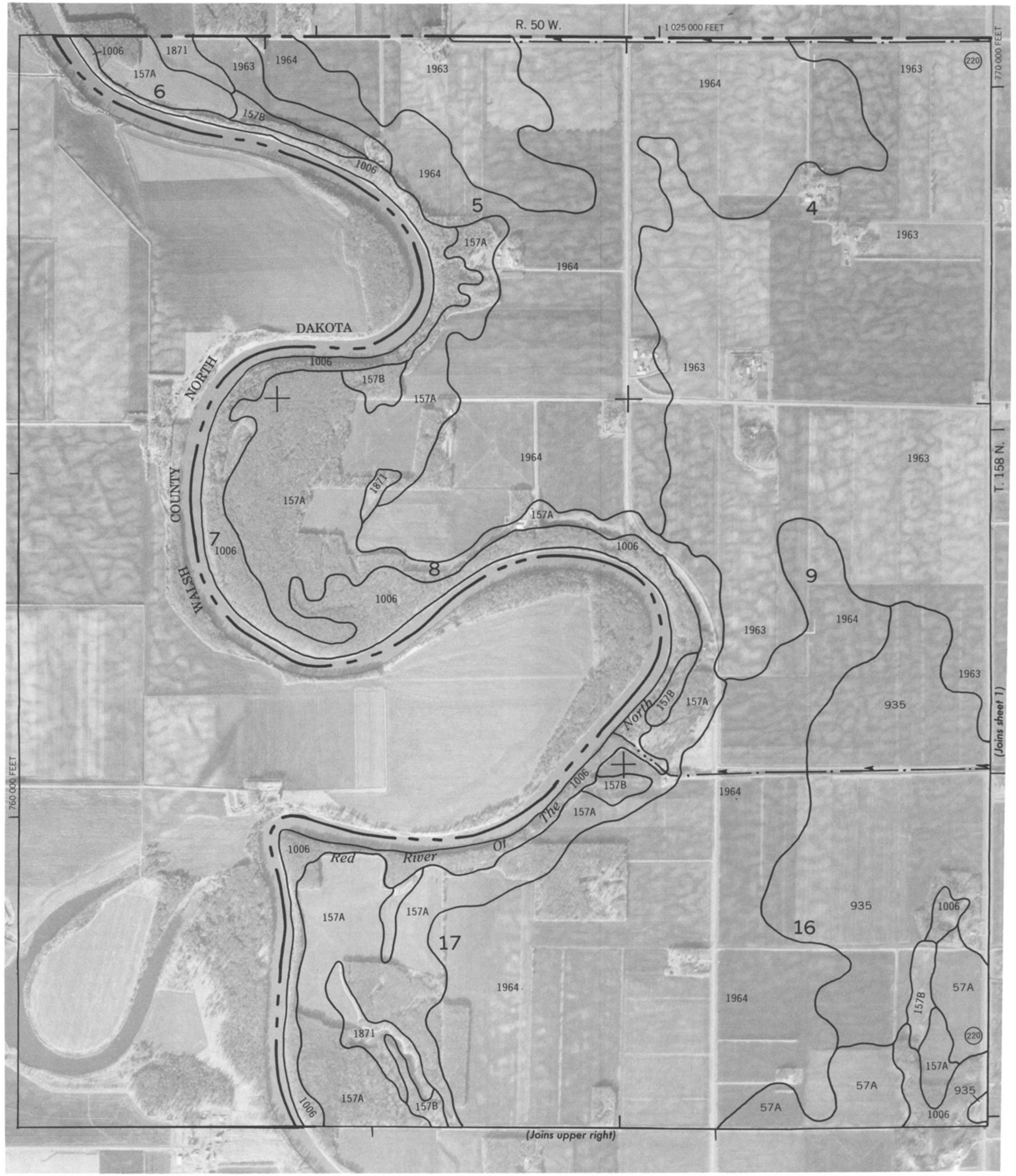
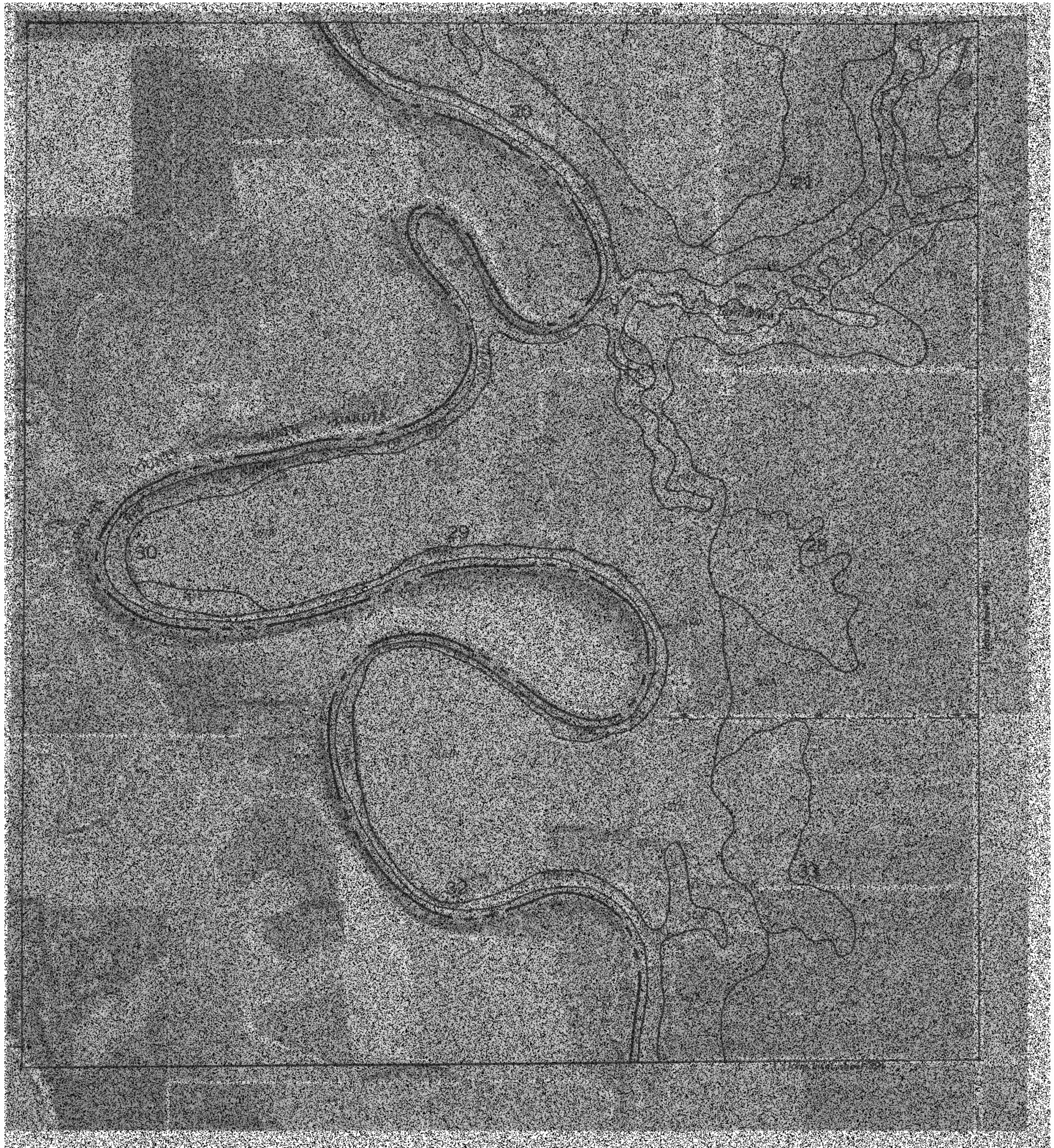
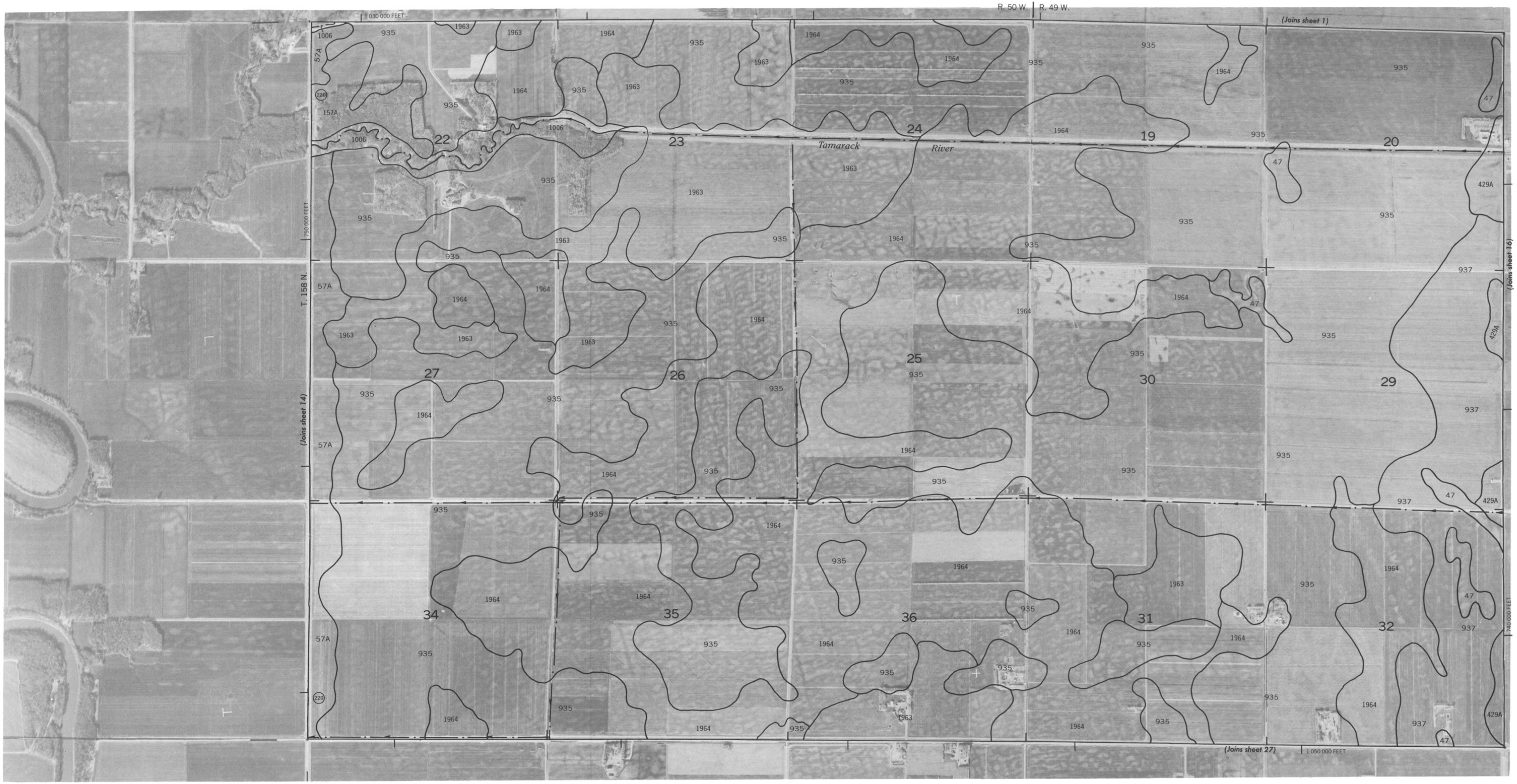
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 14



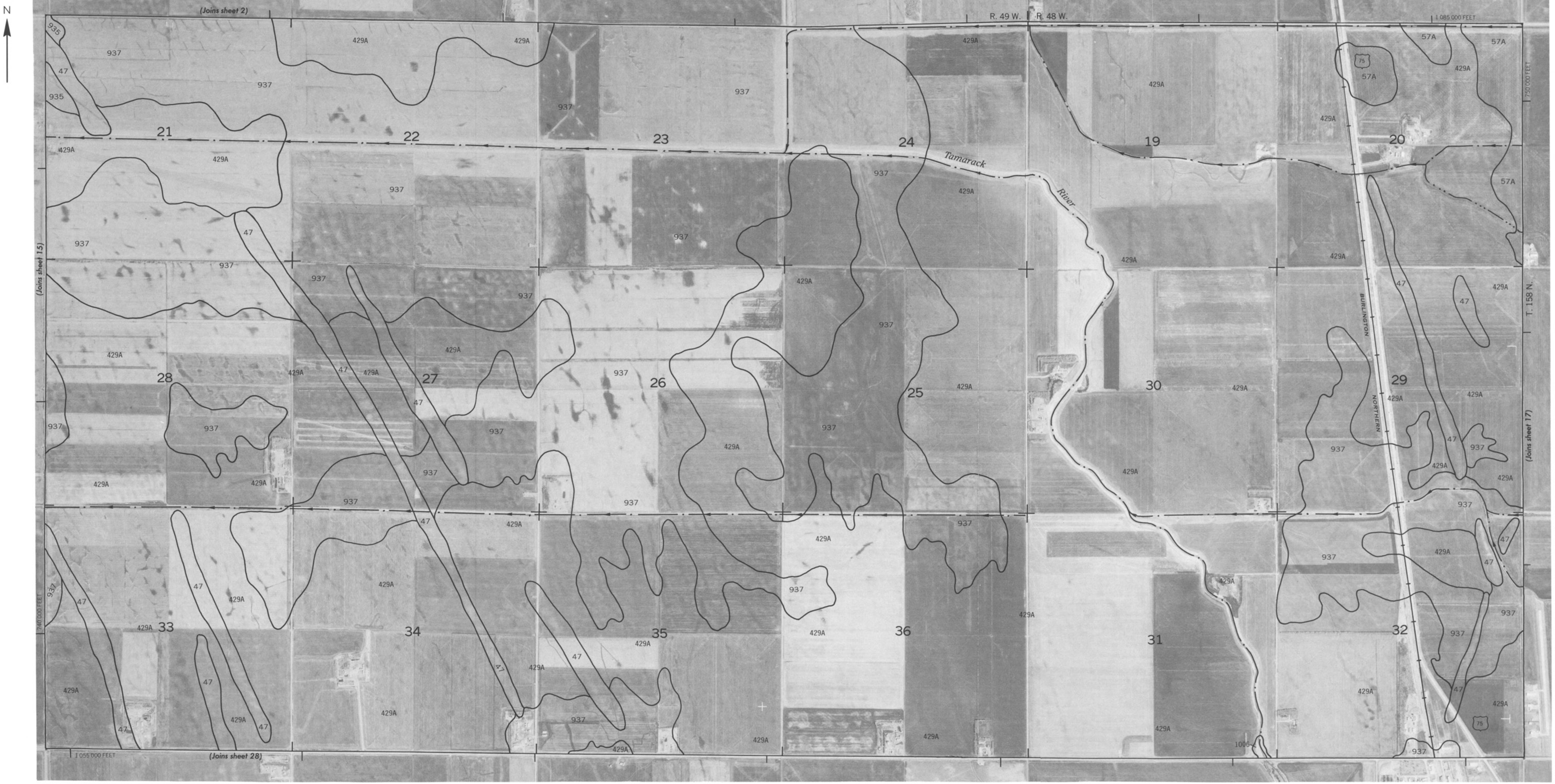
(Joins inset)
R. 50 W.
1 025 000 FEET
1006
157A
157B
1964
20
21
57A
220
Tamarack
River
750 000 FEET
T. 158 N.
WALSH
COUNTY
NORTH
DAKOTA
Red
River
Of
The
North
28
29
30
32
33
(Joins sheet 15)
(Joins inset sheet 39)


N
R. 50 W.
1 025 000 FEET
770 000 FEET
760 000 FEET
T. 158 N.
(Joins sheet 1)
(Joins upper right)
220
NORTH DAKOTA
WALSH COUNTY
The Red River Of North
6
5
4
7
8
9
16
17
1006
1871
157A
157B
1963
1964
935
57A

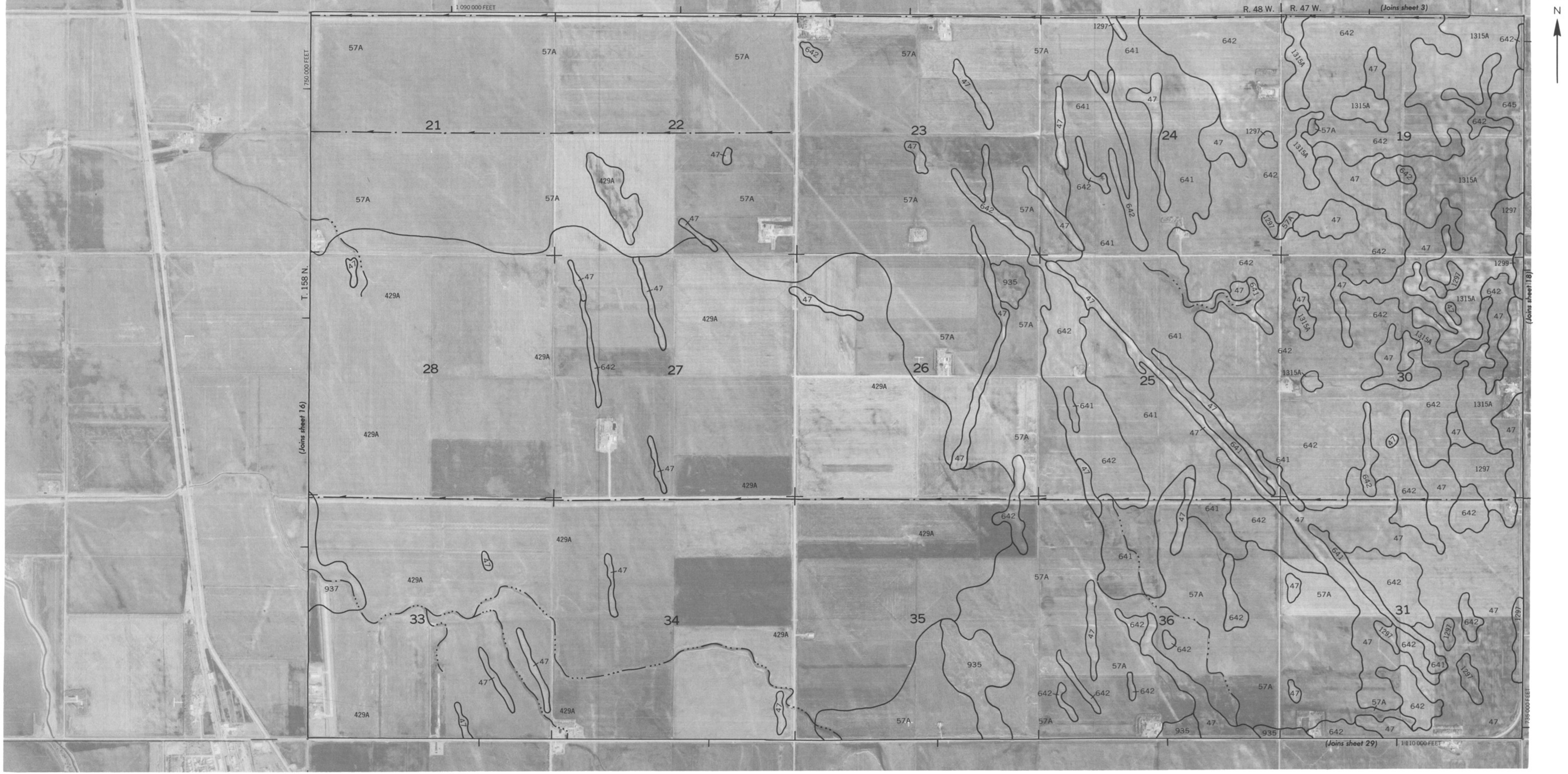

20
21
29
30
28
32


1 030 000 FEET
R. 50 W.
R. 49 W.
(Joins sheet 1)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 27)
1 050 000 FEET
750 000 FEET
740 000 FEET
T. 158 N.
Tamarack
River
N
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
220
1006
57A
157A
935
937
47
429A
1963
1964

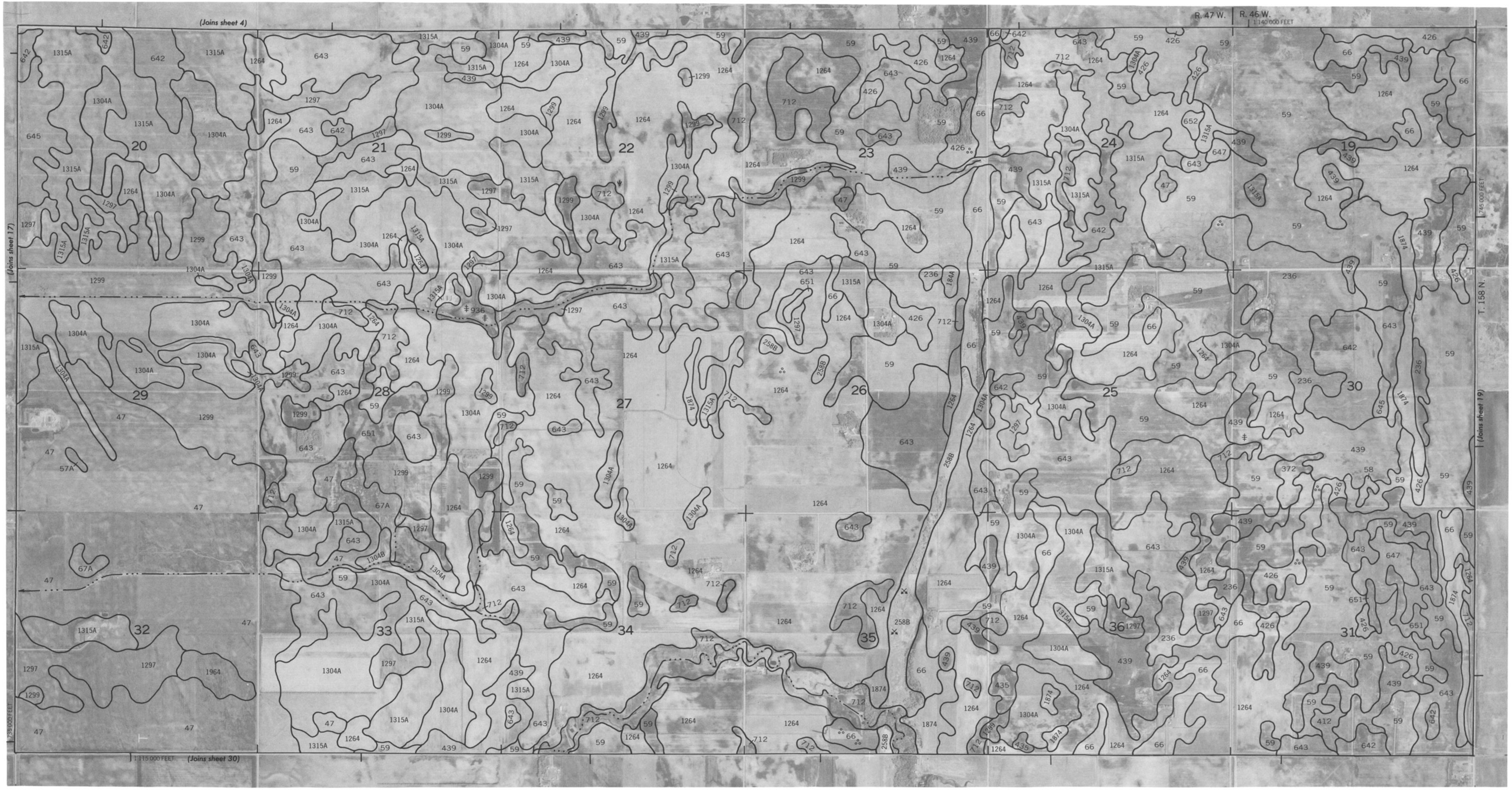
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 16


N
(Joins sheet 2)
R. 49 W.
R. 48 W.
1 085 000 FEET
750 000 FEET
T. 158 N.
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 28)
1 055 000 FEET
740 000 FEET
Tamarack
River
BURLINGTON
NORTHERN
75
21
22
23
24
19
20
28
27
26
25
30
29
33
34
35
36
31
32
935
937
47
429A
57A
1006

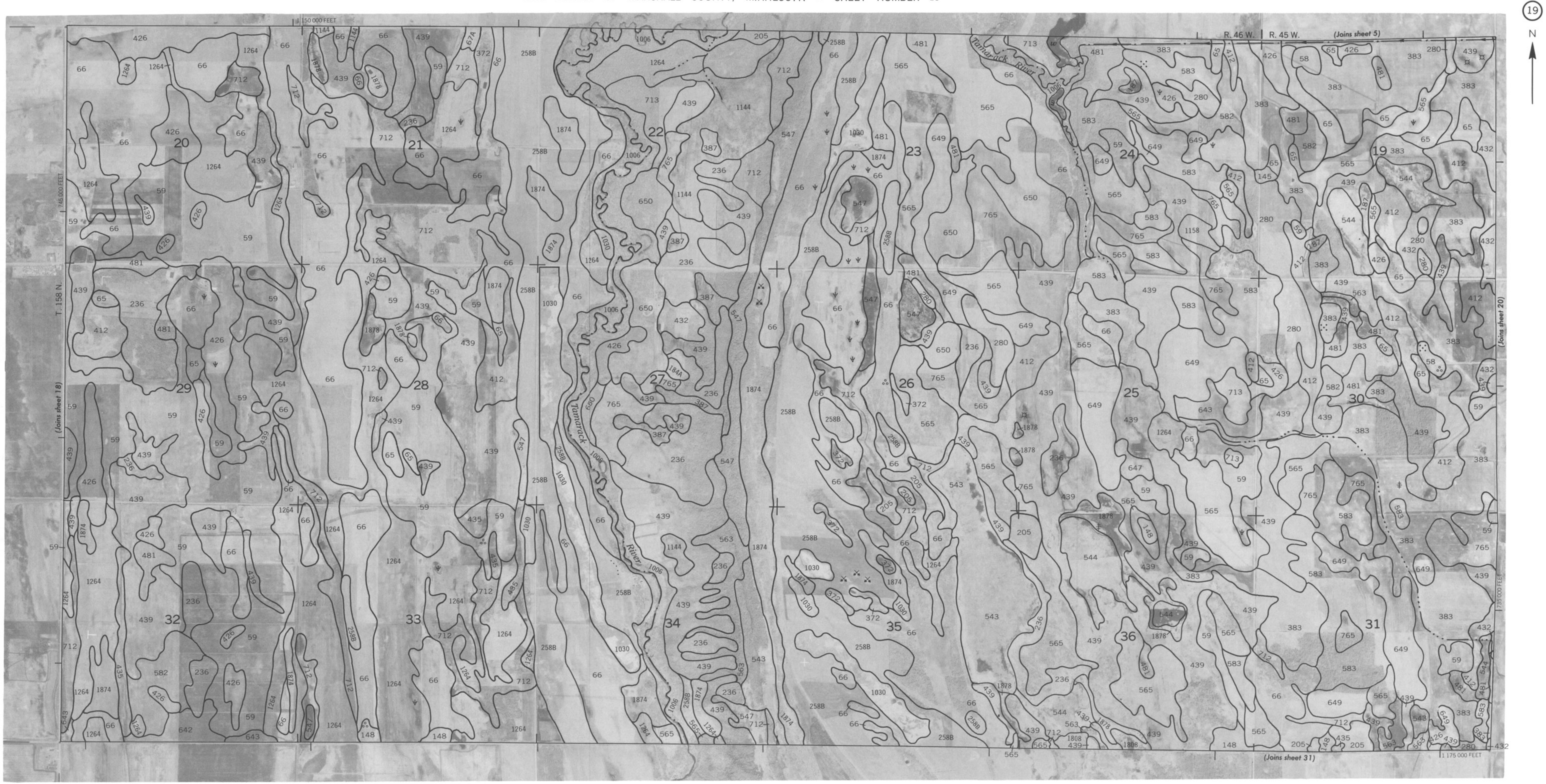
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 17


N
1 090 000 FEET
R. 48 W.
R. 47 W.
(Joins sheet 3)
750 000 FEET
T. 158 N.
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 29)
1 110 000 FEET
735 000 FEET
19
21
22
23
24
25
26
27
28
30
31
33
34
35
36
57A
429A
47
641
642
645
935
937
1297
1299
1315A

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 18


N
(Joins sheet 4)
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 30)
R. 47 W.
R. 46 W.
1 140 000 FEET
745 000 FEET
T. 158 N.
1 115 000 FEET
738 000 FEET
20
21
22
23
24
19
29
28
27
26
25
30
32
33
34
35
36
31

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 19



19
N
R. 46 W.
R. 45 W.
(Joins sheet 5)
(Joins sheet 20)
(Joins sheet 31)
(Joins sheet 18)
T. 158 N.
1 150 000 FEET
745 000 FEET
735 000 FEET
1 175 000 FEET
Tamarack River
Tamarack River
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 20

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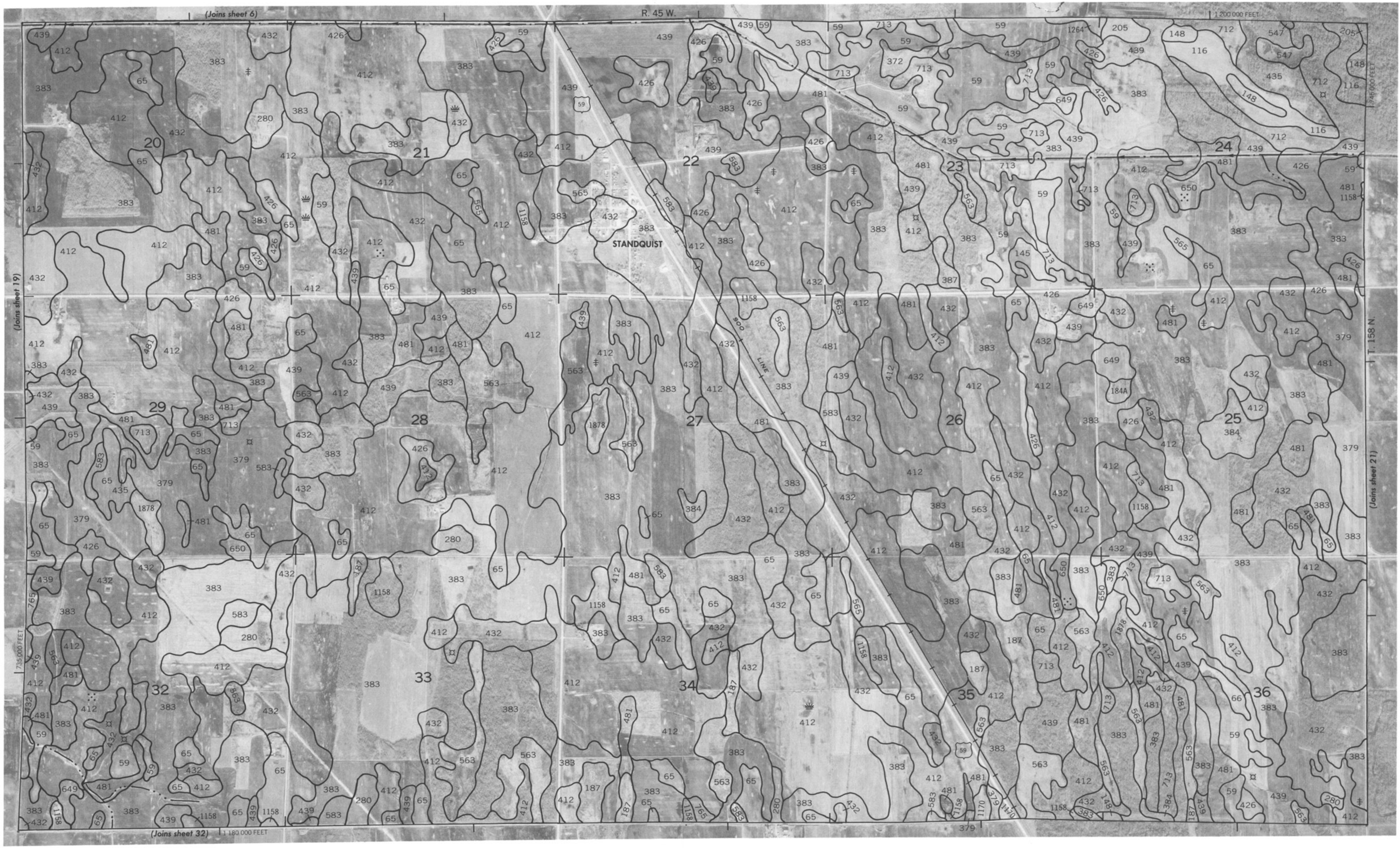
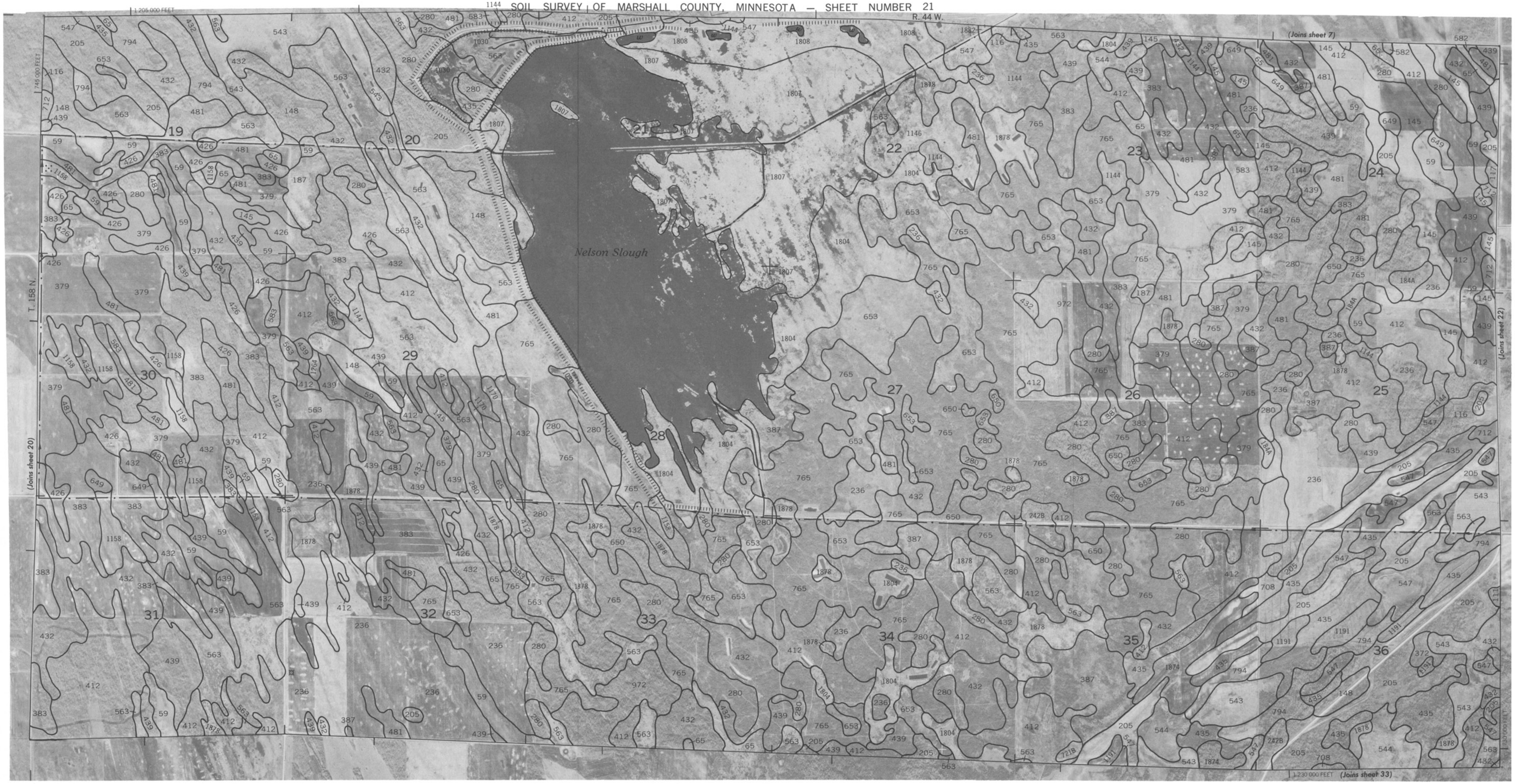
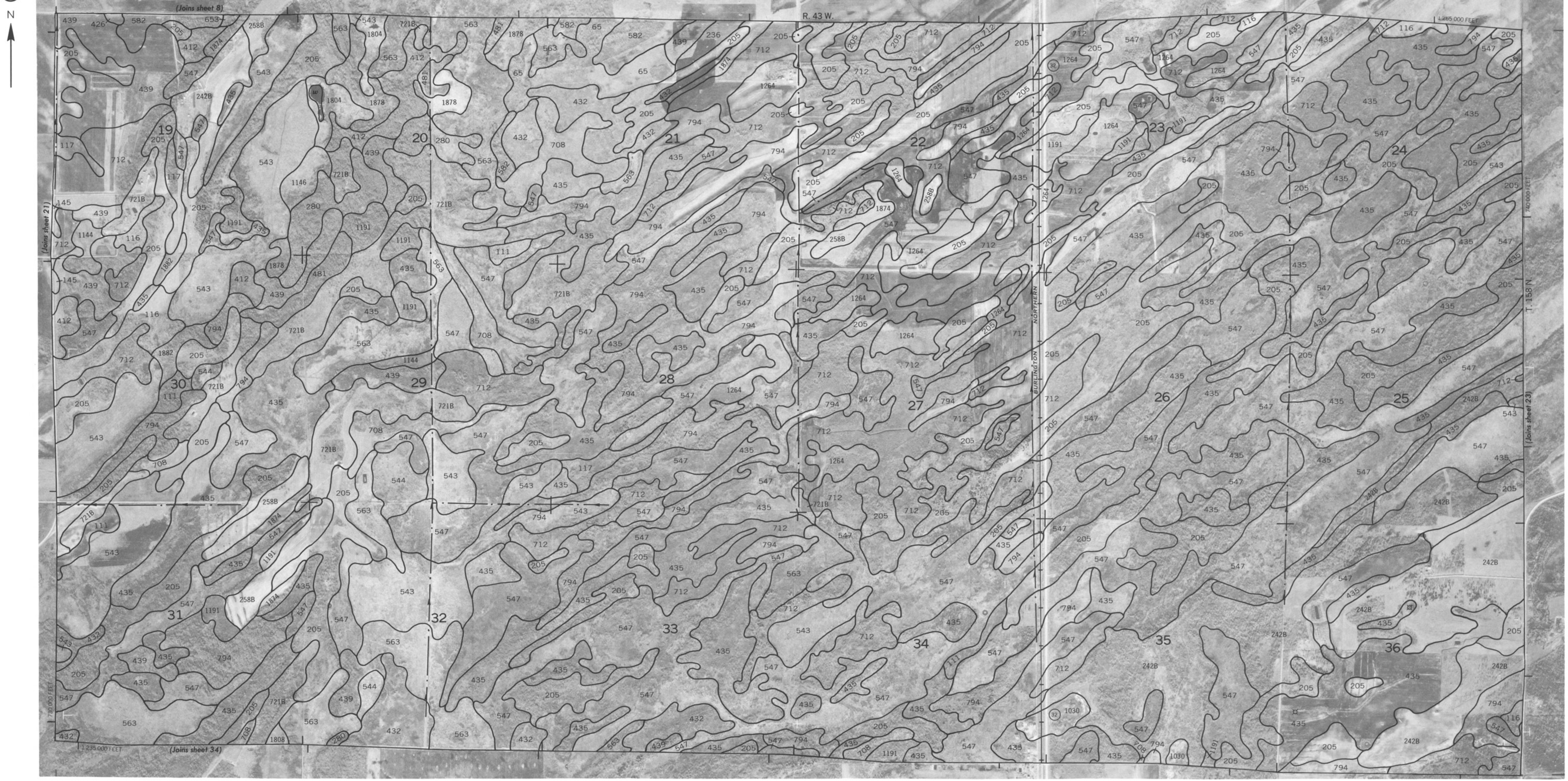
N

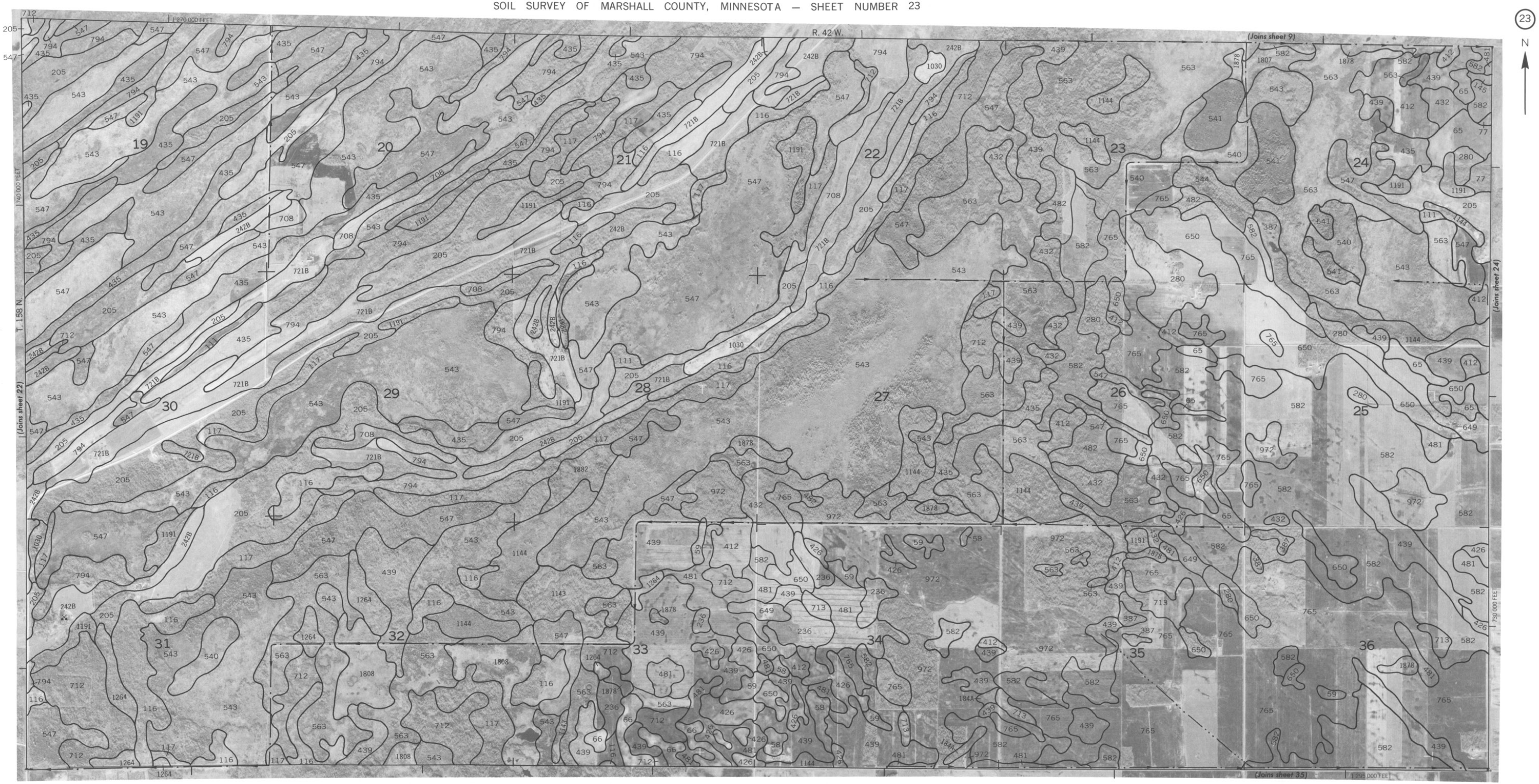

(Joins sheet 6)
R. 45 W.
1 200 000 FEET
(Joins sheet 19)
(Joins sheet 21)
T. 158 N.
(Joins sheet 32)
1 180 000 FEET
735 000 FEET
STANDQUIST
SOO LINE
59
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 21

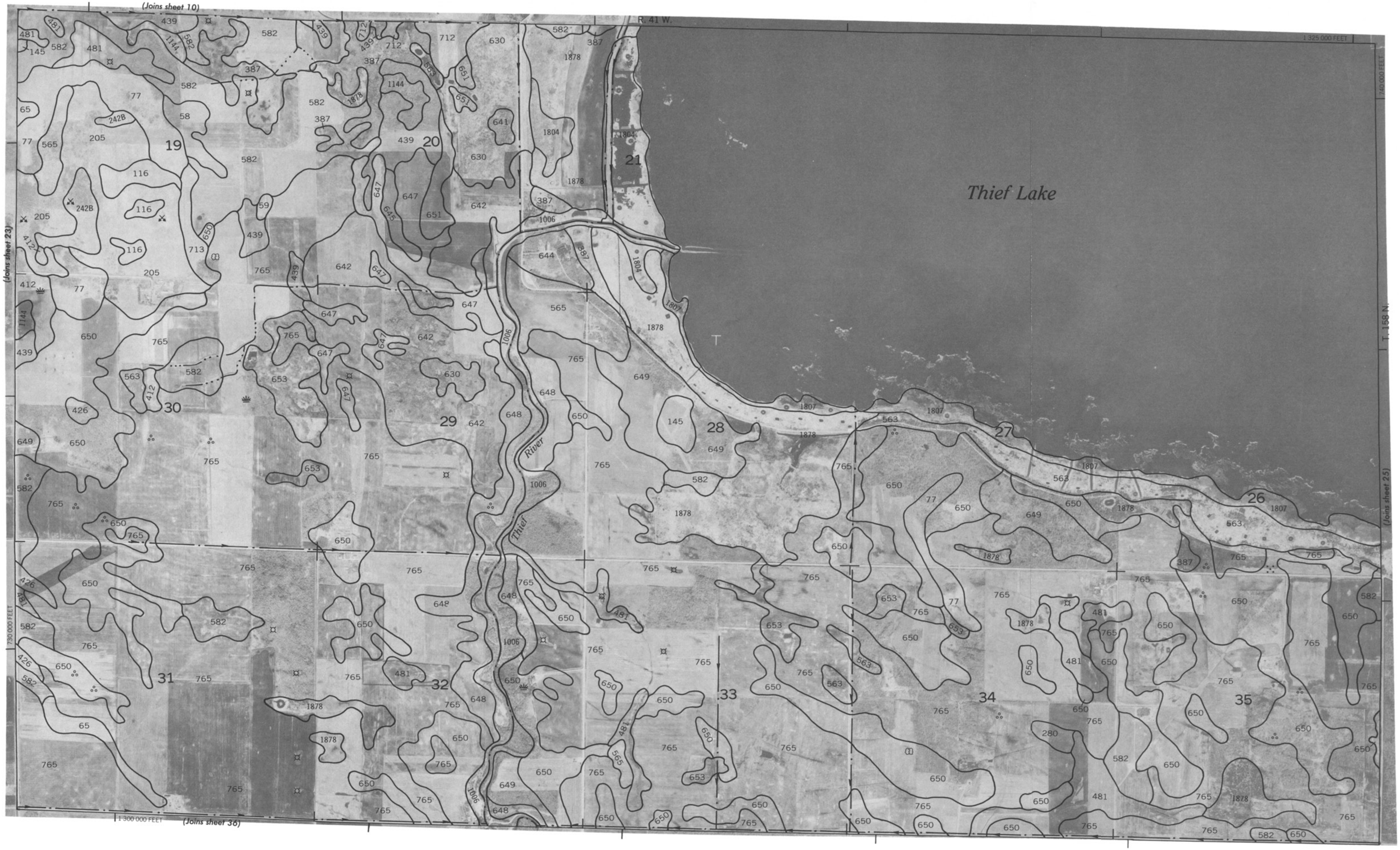

N
1 205 000 FEET
R. 44 W.
(Joins sheet 7)
746 000 FEET
T. 158 N.
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 33)
1 230 000 FEET
Nelson Slough
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36


N
(Joins sheet 8)
R. 43 W.
1 265 000 FEET
(Joins sheet 21)
(Joins sheet 23)
T. 158 N.
740 000 FEET
730 000 FEET
1 235 000 FEET
(Joins sheet 34)
BURLINGTON
NORTHERN
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36

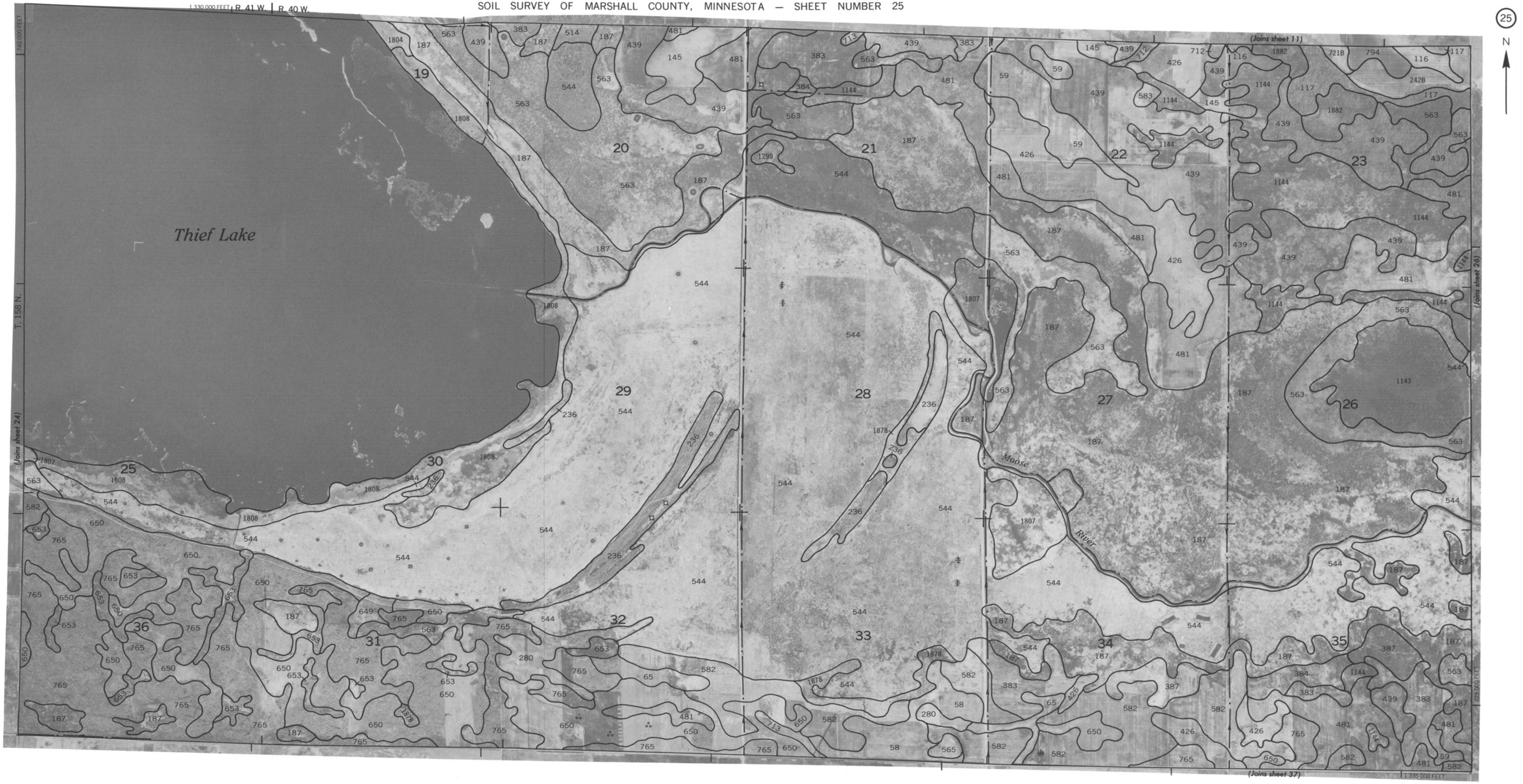
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 23


N
R. 42 W.
T. 158 N.
1 270 000 FEET
740 000 FEET
730 000 FEET
1 295 000 FEET
(Joins sheet 9)
(Joins sheet 24)
(Joins sheet 35)
(Joins sheet 22)
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36

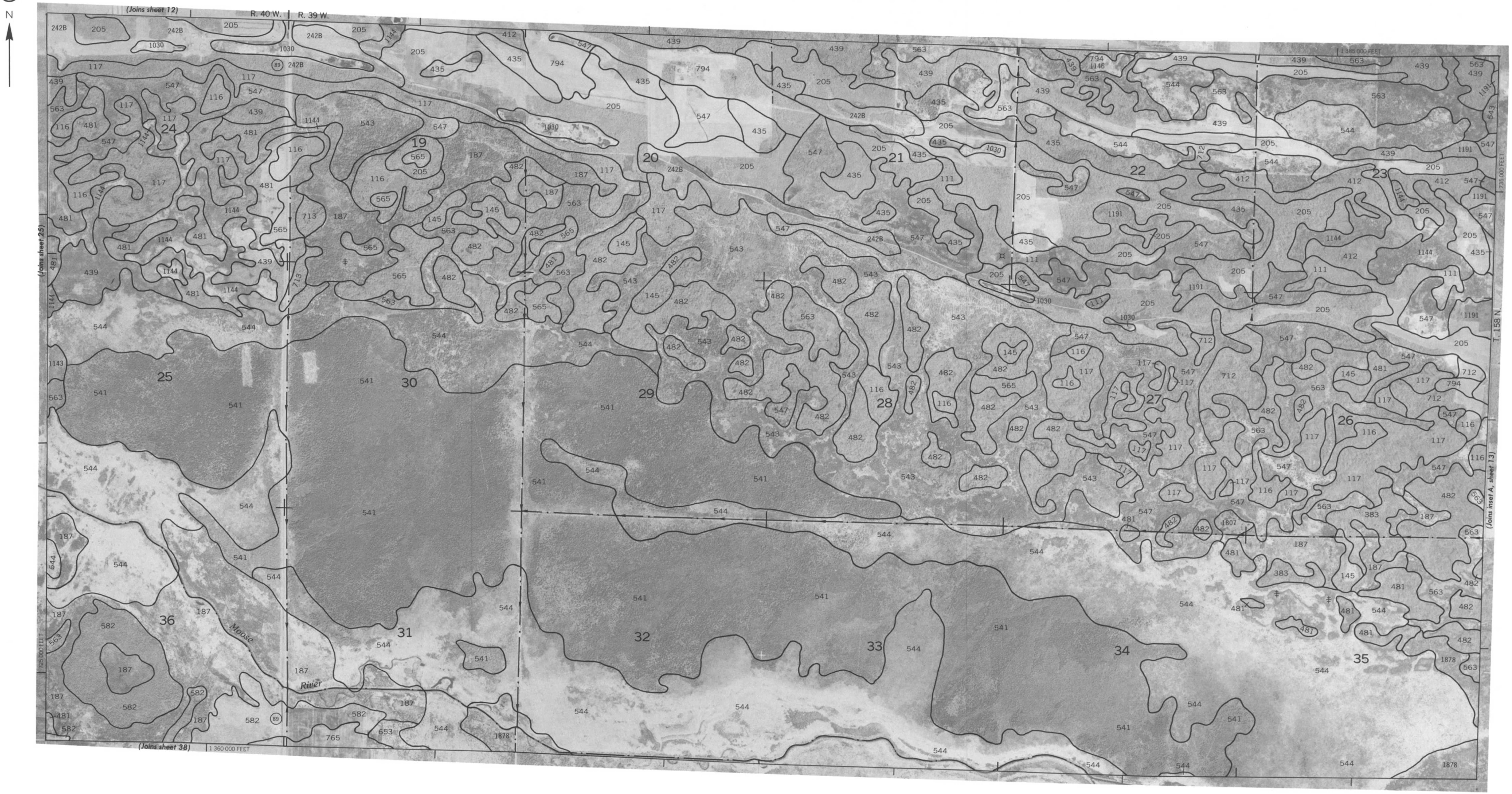
N

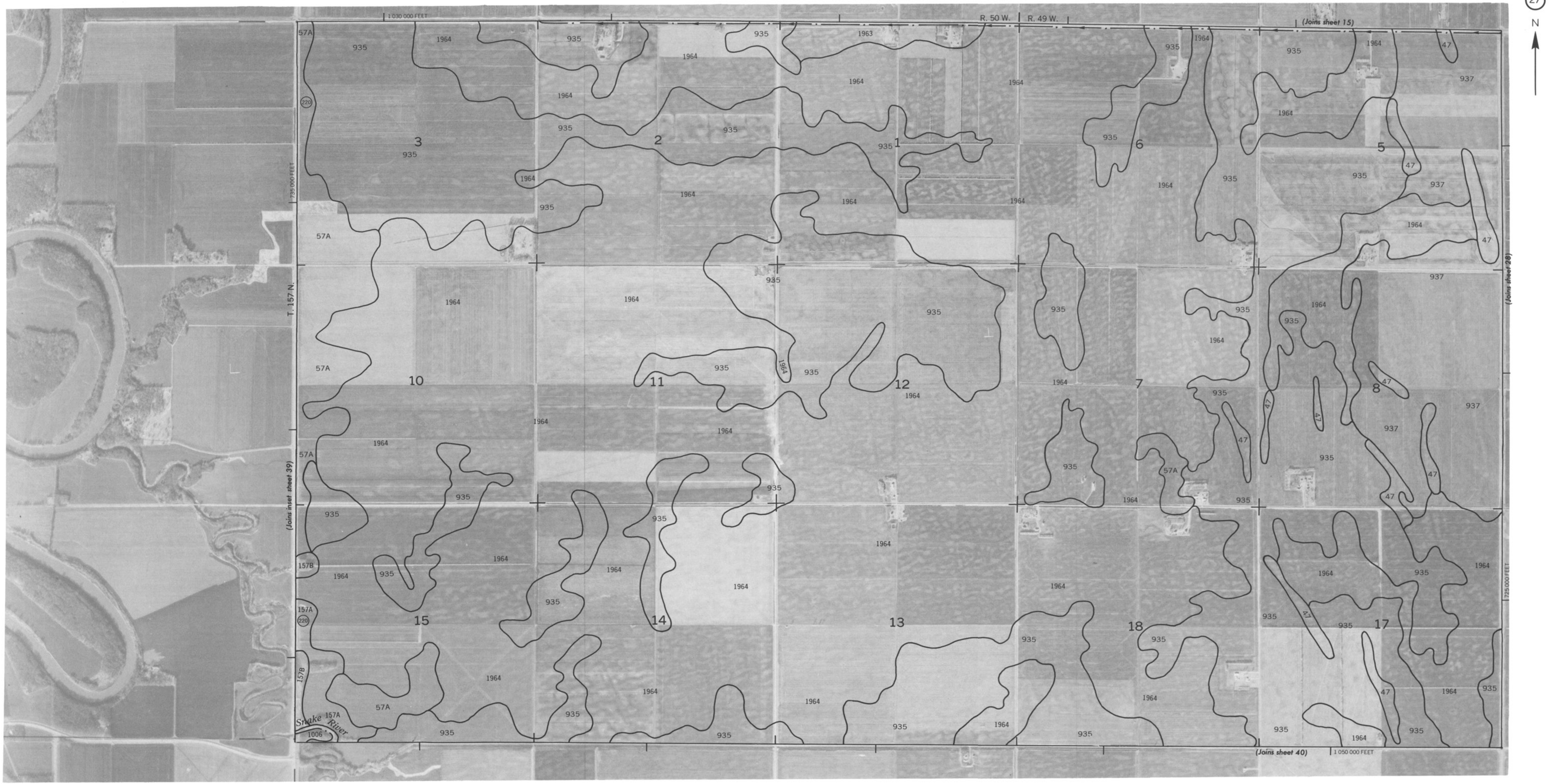

(Joins sheet 10)
R. 41 W.
1 325 000 FEET
740 000 FEET
T. 158 N.
(Joins sheet 25)
(Joins sheet 23)
730 000 FEET
1 300 000 FEET
(Joins sheet 36)
Thief Lake
Thief River
19
20
21
26
27
28
29
30
31
32
33
34
35

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 25

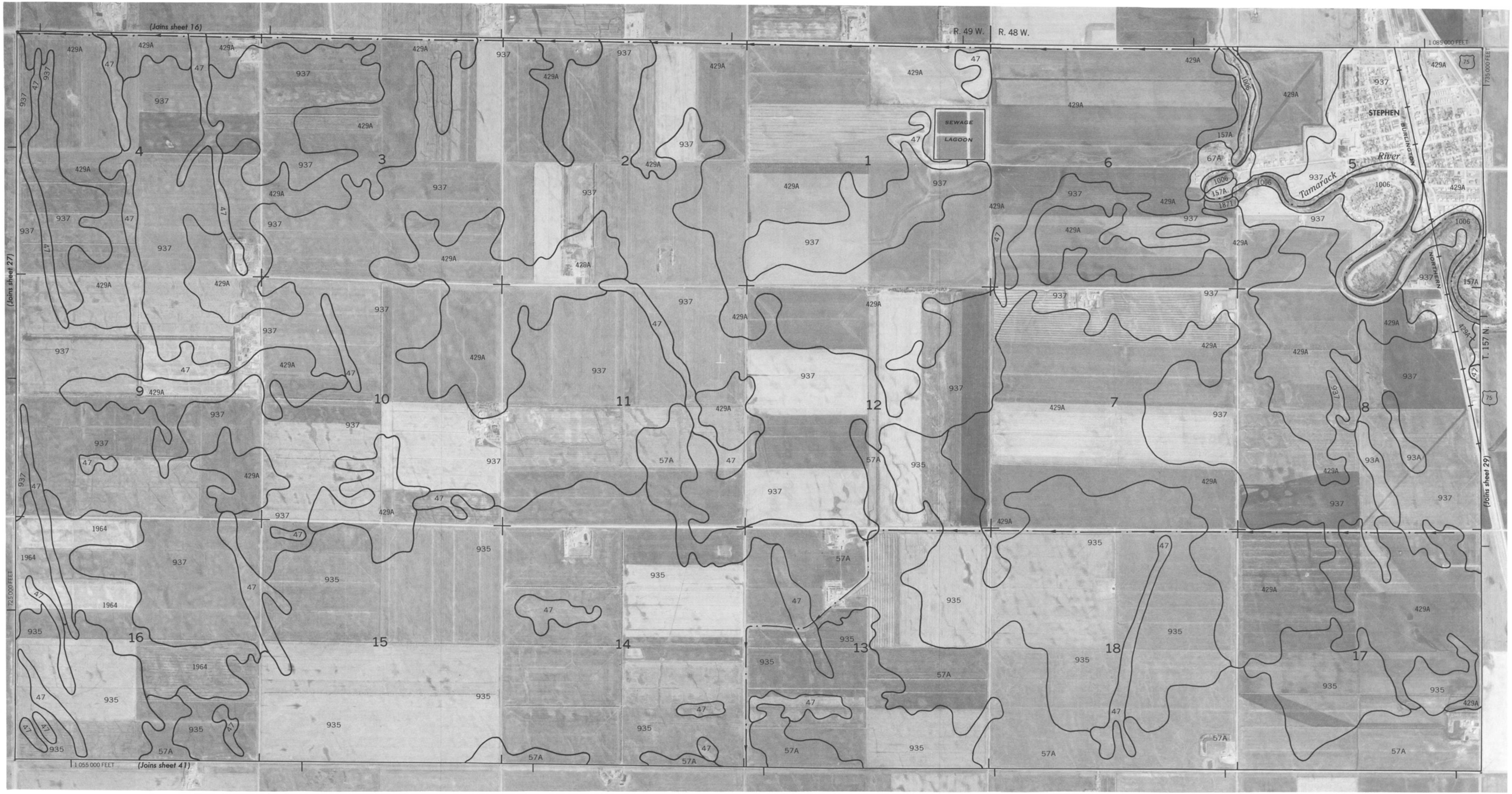

25
N
1 330 000 FEET
R. 41 W.
R. 40 W.
740 000 FEET
T. 158 N.
(Joins sheet 11)
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 37)
725 000 FEET
1 335 000 FEET
Thief Lake
Moose River
19
20
21
22
23
25
26
27
28
29
30
31
32
33
34
35
36
1804
187
563
439
383
514
481
145
713
1144
384
59
583
426
712
116
1882
721B
794
242B
117
1299
544
1808
1807
236
1878
1143
582
650
653
765
649
280
65
58
565
387

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 26

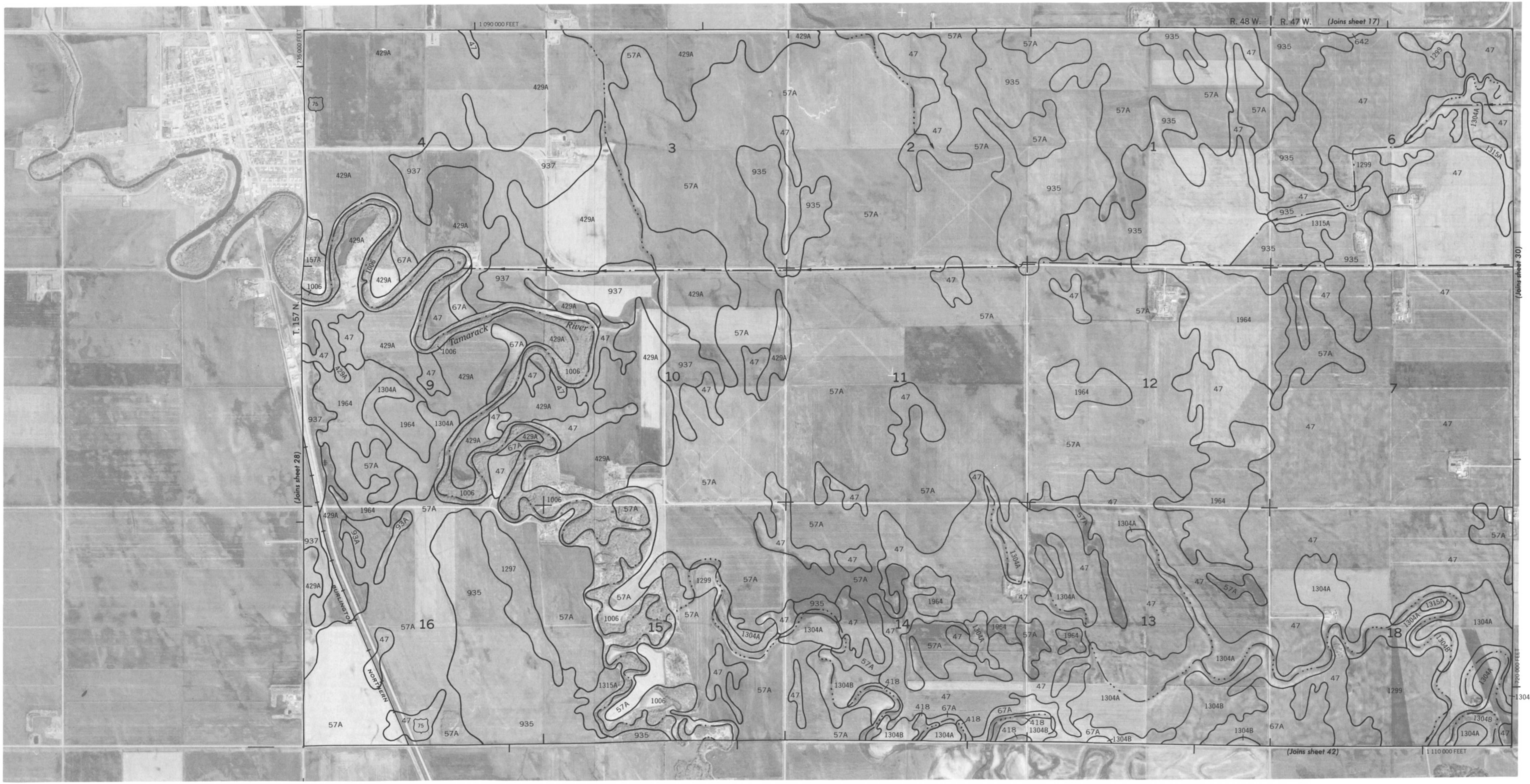

N
(Joins sheet 12)
R. 40 W.
R. 39 W.
1 385 000 FEET
735 000 FEET
T. 158 N.
(Joins inset A, sheet 13)
(Joins sheet 25)
725 000 FEET
(Joins sheet 38)
1 360 000 FEET
Moose
River
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
89


N
1 030 000 FEET
R. 50 W.
R. 49 W.
(Joins sheet 15)
(Joins sheet 28)
(Joins sheet 40)
(Joins inset sheet 39)
1 050 000 FEET
735 000 FEET
725 000 FEET
T. 157 N.
Snake River
220
1
2
3
5
6
7
8
10
11
12
13
14
15
17
18
47
57A
157A
157B
935
937
1006
1963
1964

N

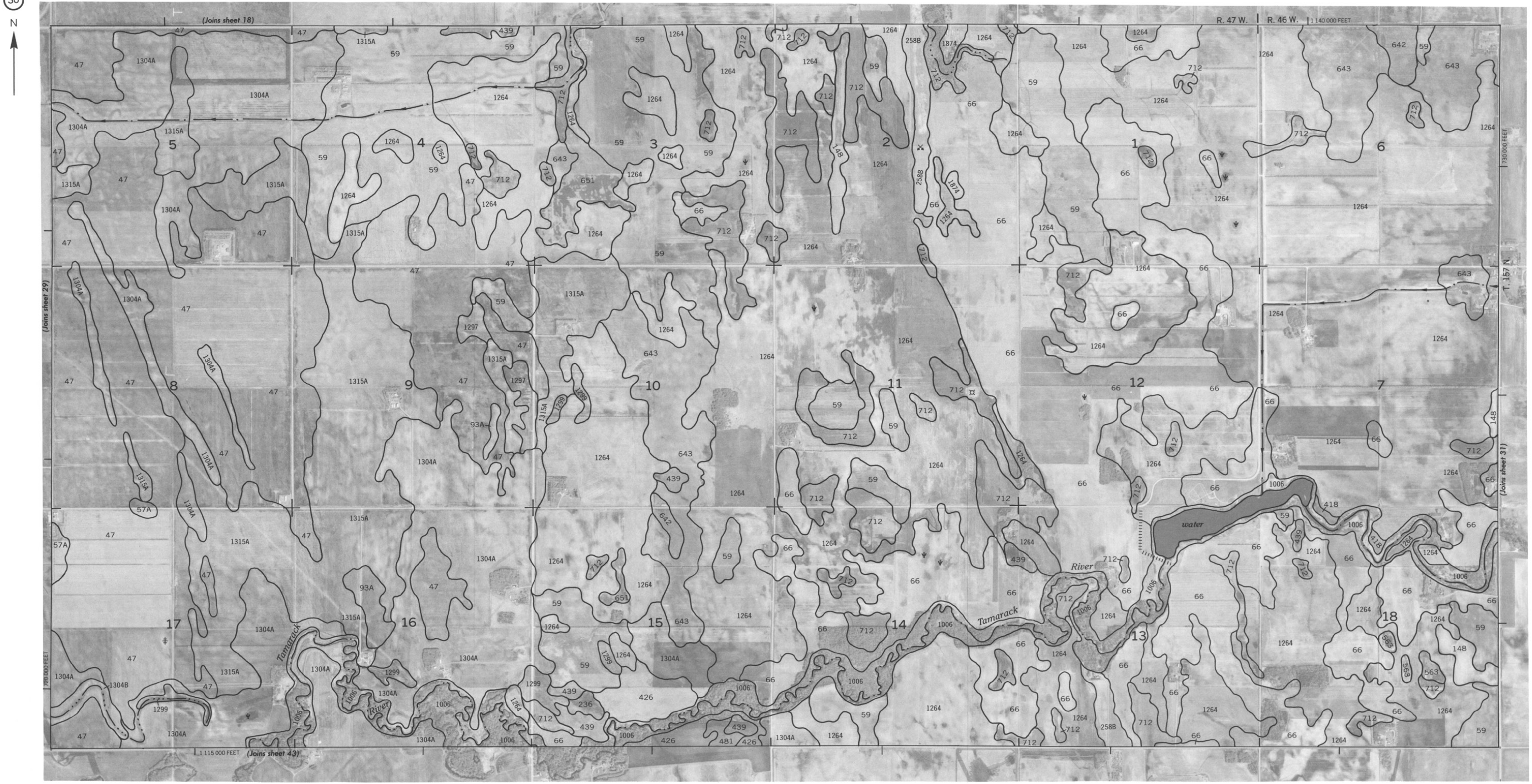

(Joins sheet 16)
R. 49 W.
R. 48 W.
1 085 000 FEET
735 000 FEET
STEPHEN
BURLINGTON
NORTHERN
Tamarack
River
SEWAGE
LAGOON
75
T. 157 N.
(Joins sheet 27)
(Joins sheet 29)
725 000 FEET
1 055 000 FEET
(Joins sheet 41)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
429A
937
935
47
57A
157A
67A
1006
1871
1964
93A

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 29

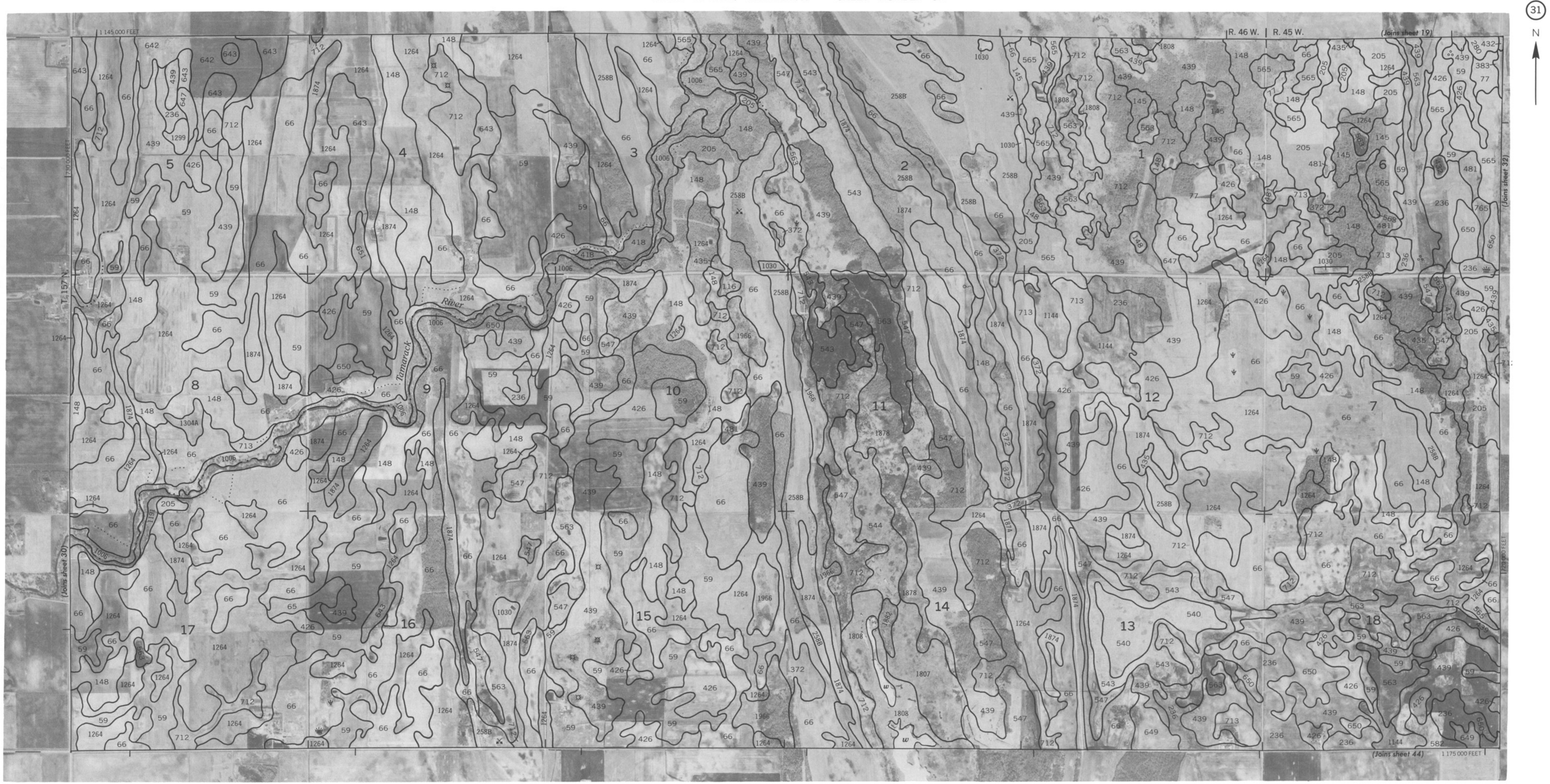


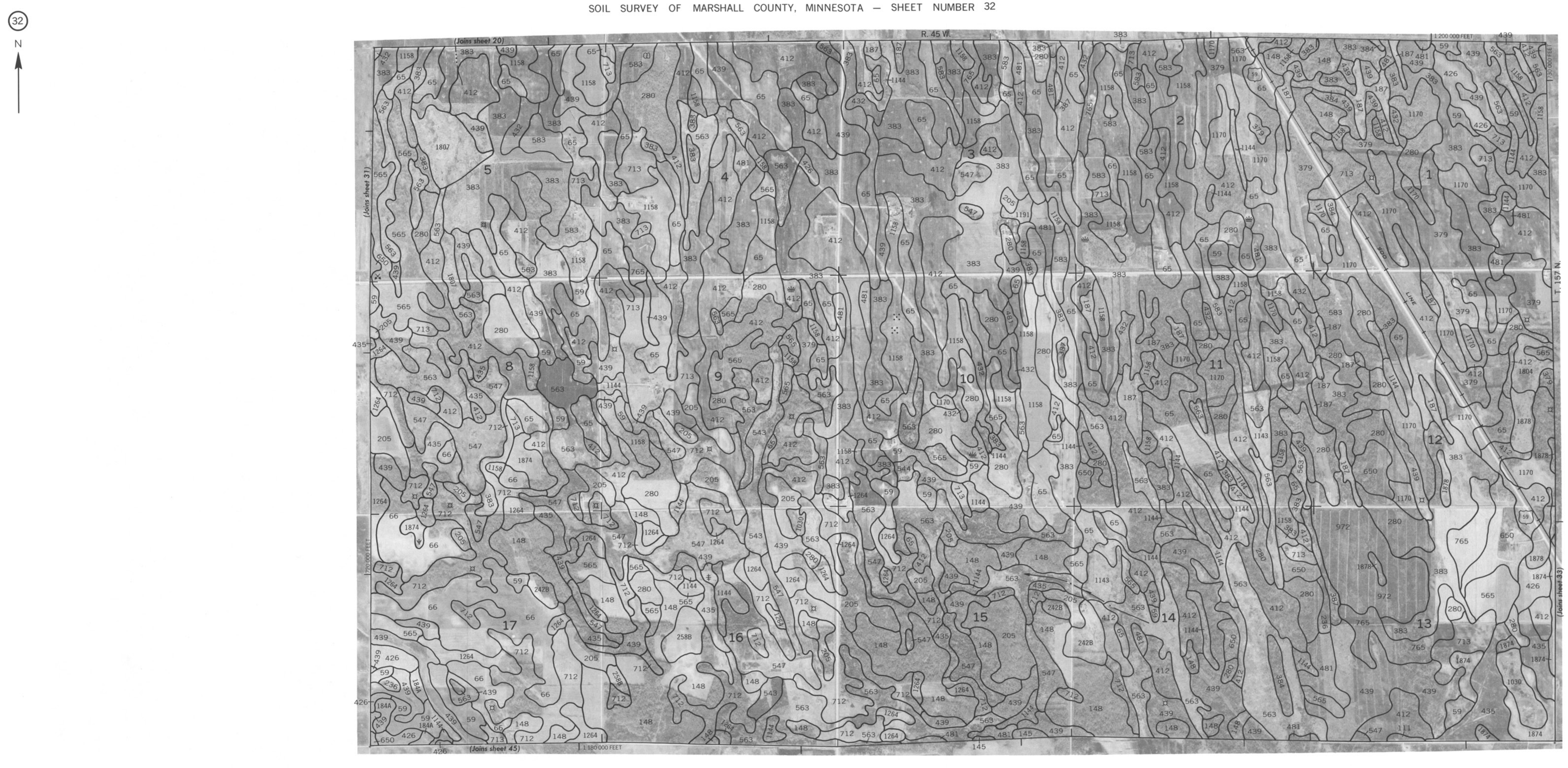
29
N
R. 48 W.
R. 47 W.
(Joins sheet 17)
(Joins sheet 30)
(Joins sheet 42)
(Joins sheet 28)
T. 157 N.
1 090 000 FEET
735 000 FEET
1 110 000 FEET
720 000 FEET
75
Tamarack
River
BURLINGTON
NORTHERN
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18
47
57A
67A
93A
157A
418
429A
642
935
937
1006
1297
1299
1304A
1304B
1315A
1964

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 30

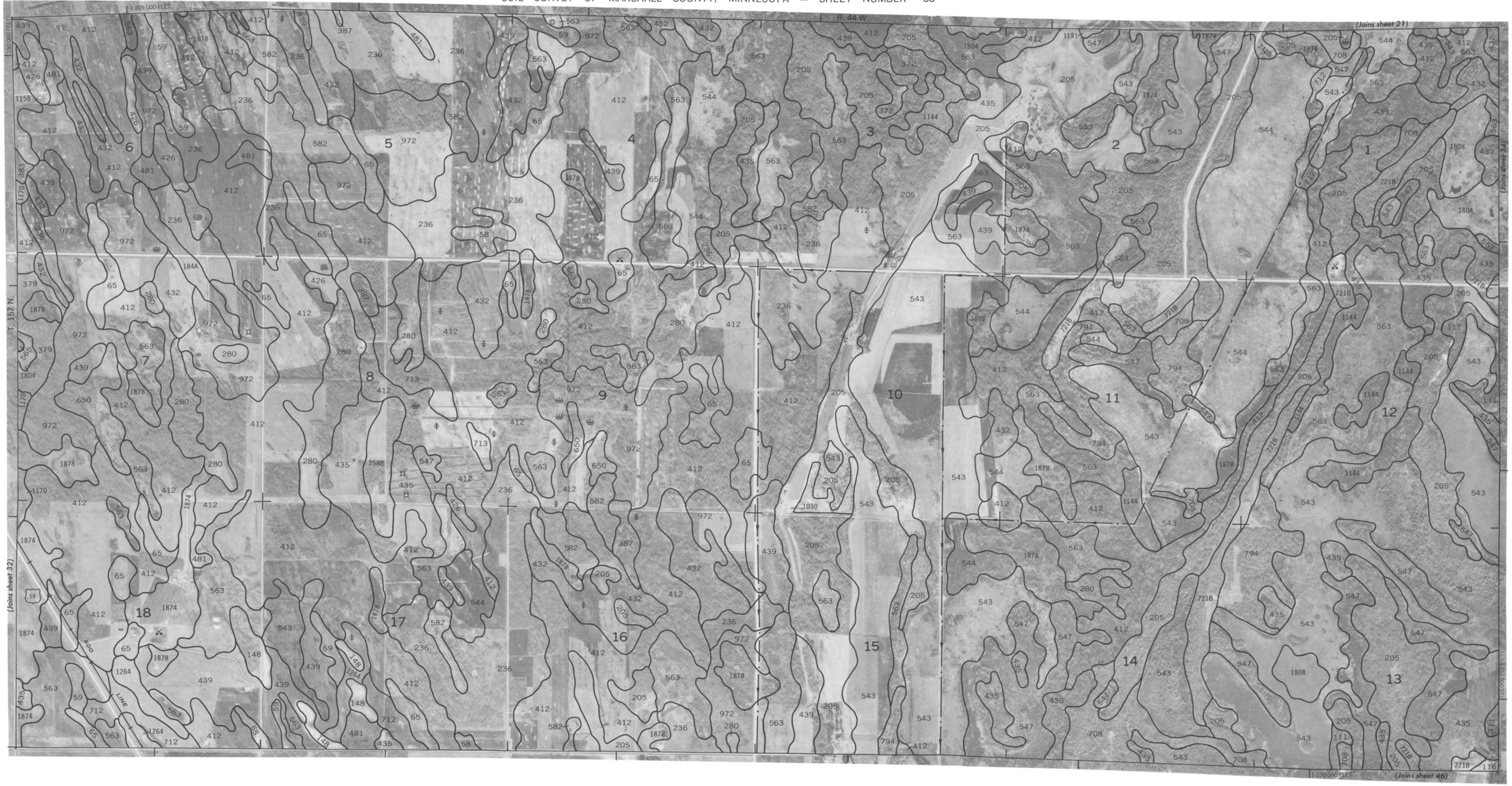

N
(Joins sheet 18)
R. 47 W.
R. 46 W.
1 140 000 FEET
730 000 FEET
T. 157 N.
(Joins sheet 31)
(Joins sheet 29)
720 000 FEET
1 115 000 FEET
(Joins sheet 43)
Tamarack River
Tamarack River
water
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 31

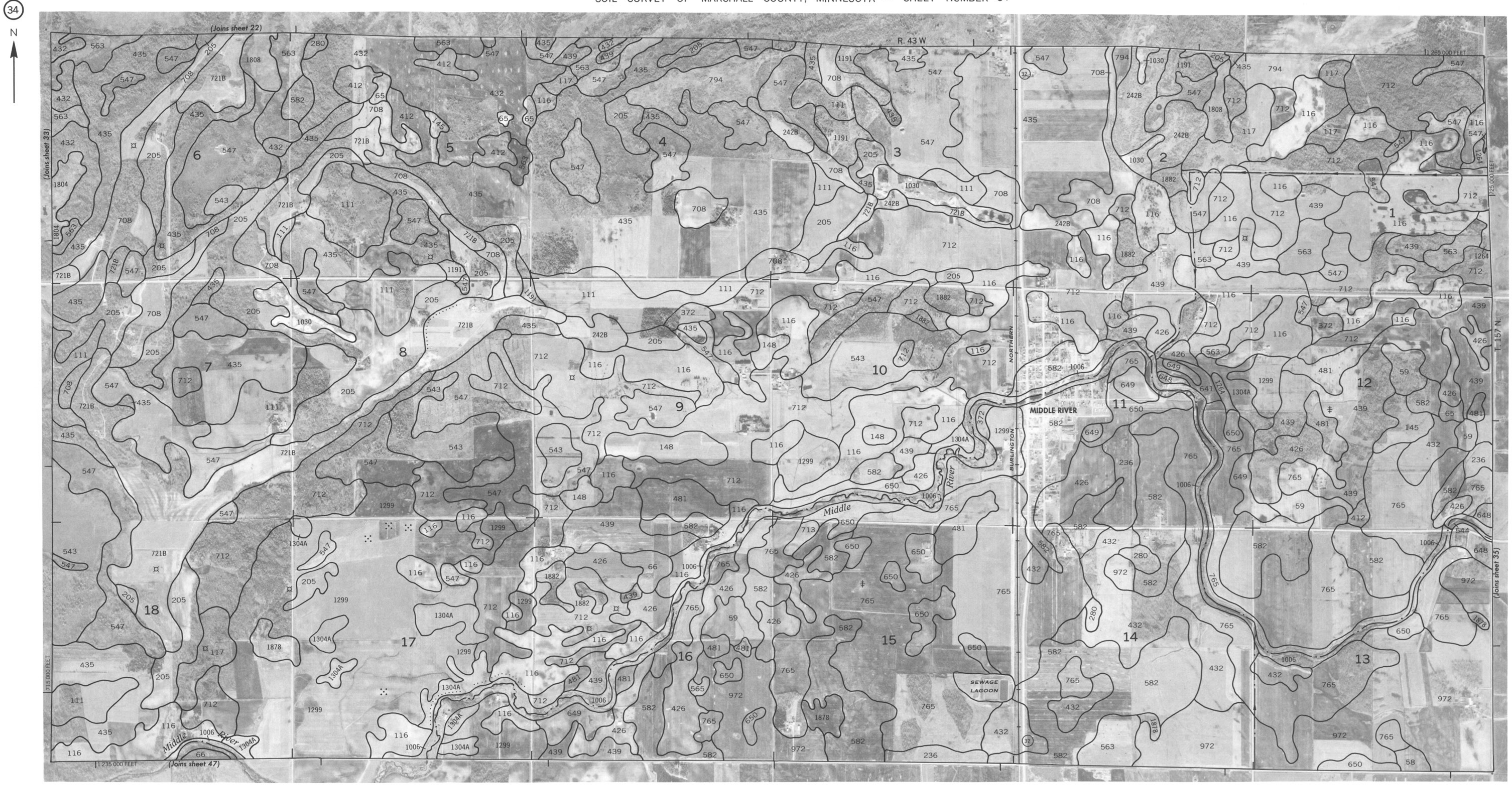

31
N
1 145 000 FEET
R. 46 W.
R. 45 W.
(Joins sheet 19)
730 000 FEET
T. 157 N.
(Joins sheet 30)
(Joins sheet 32)
Tamarack
River
720 000 FEET
(Joins sheet 44)
1 175 000 FEET
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

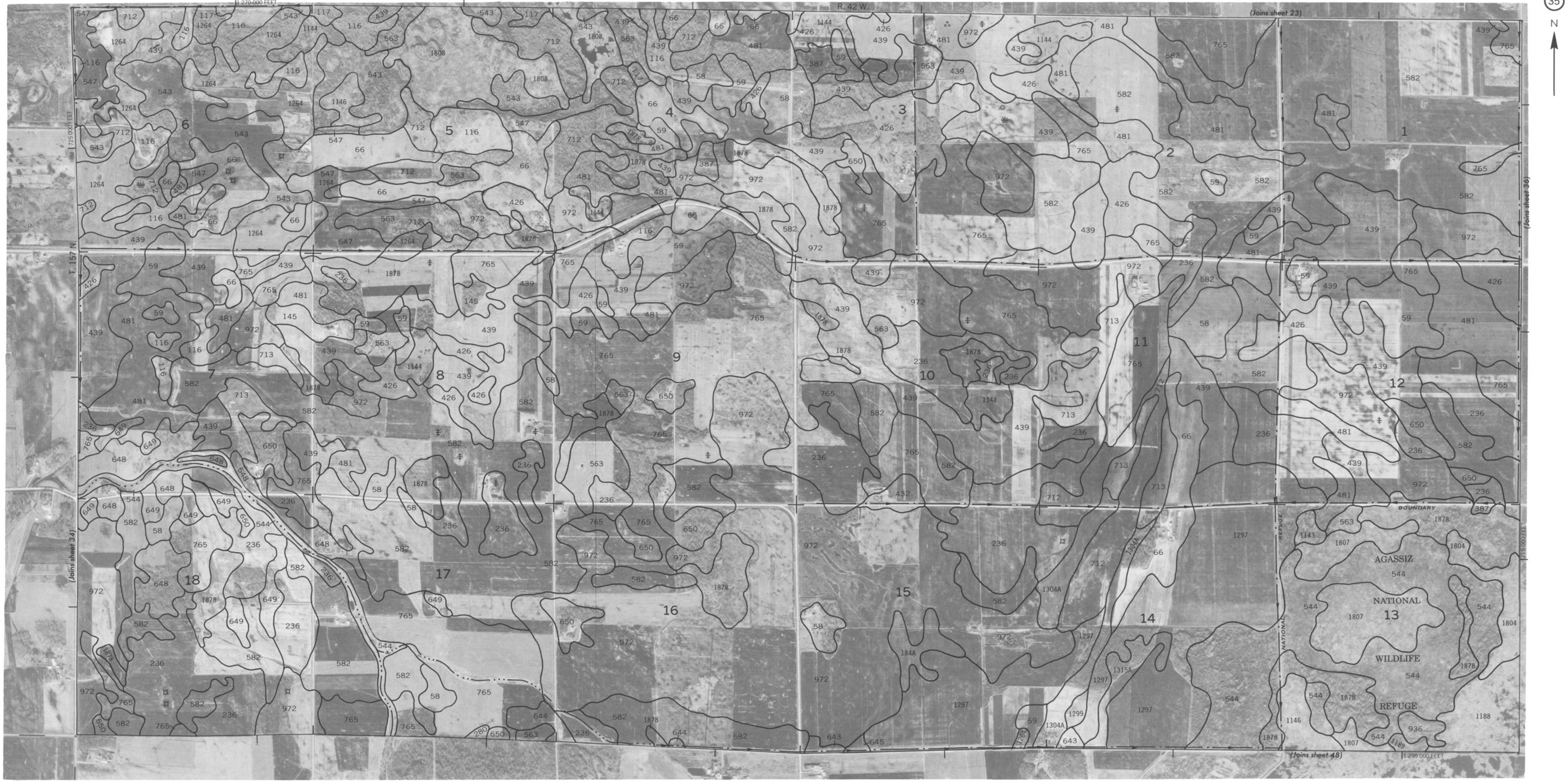

N
(Joins sheet 20)
R. 45 W.
1 200 000 FEET
730 000 FEET
T. 157 N.
(Joins sheet 31)
720 000 FEET
(Joins sheet 33)
(Joins sheet 45)
1 180 000 FEET
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17

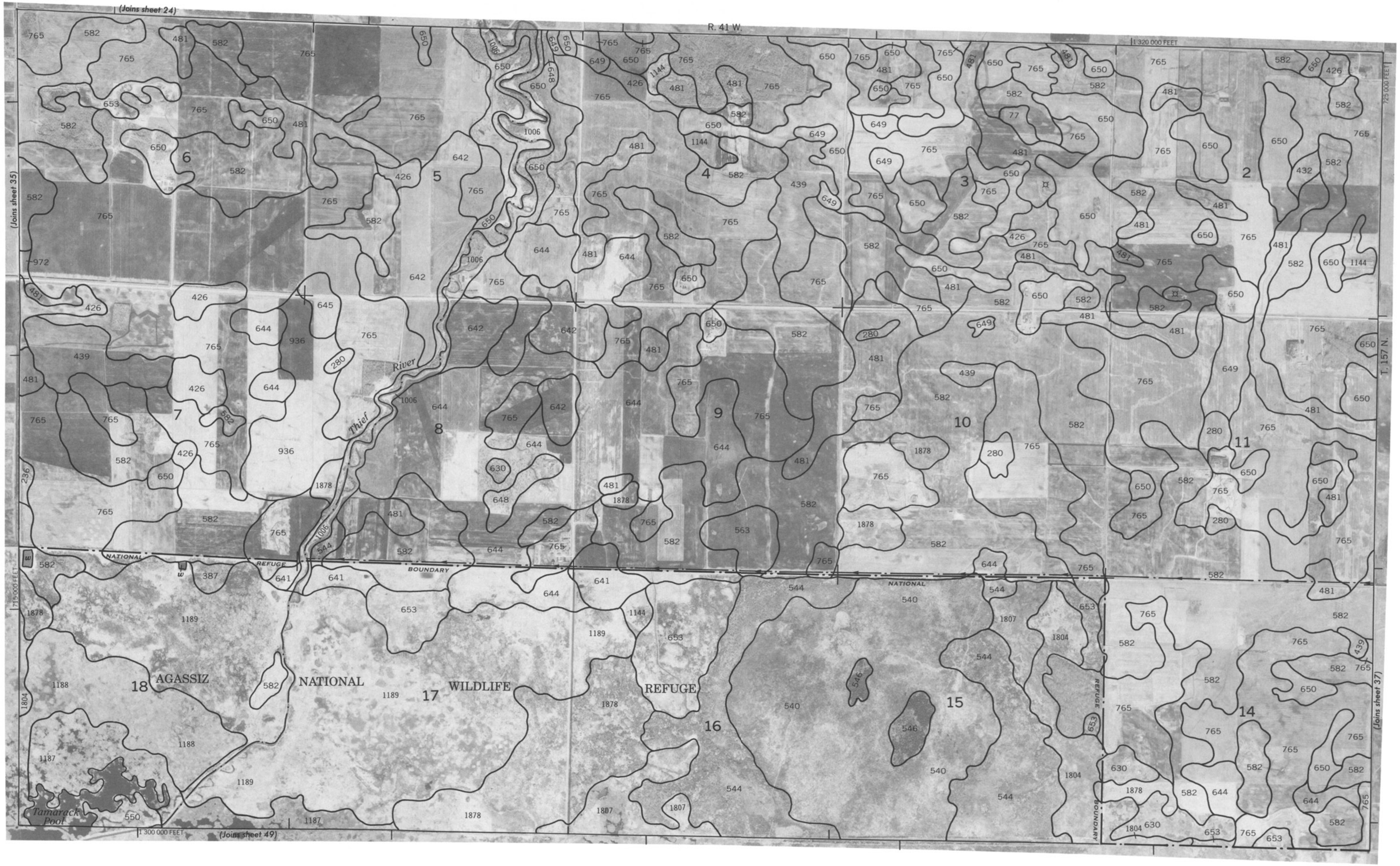
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 33


N
1 205 000 FEET
R. 44 W.
(Joins sheet 21)
230 000 FEET
T. 157 N.
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 46)
1 230 000 FEET
150 000 FEET
SOO LINE
59
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

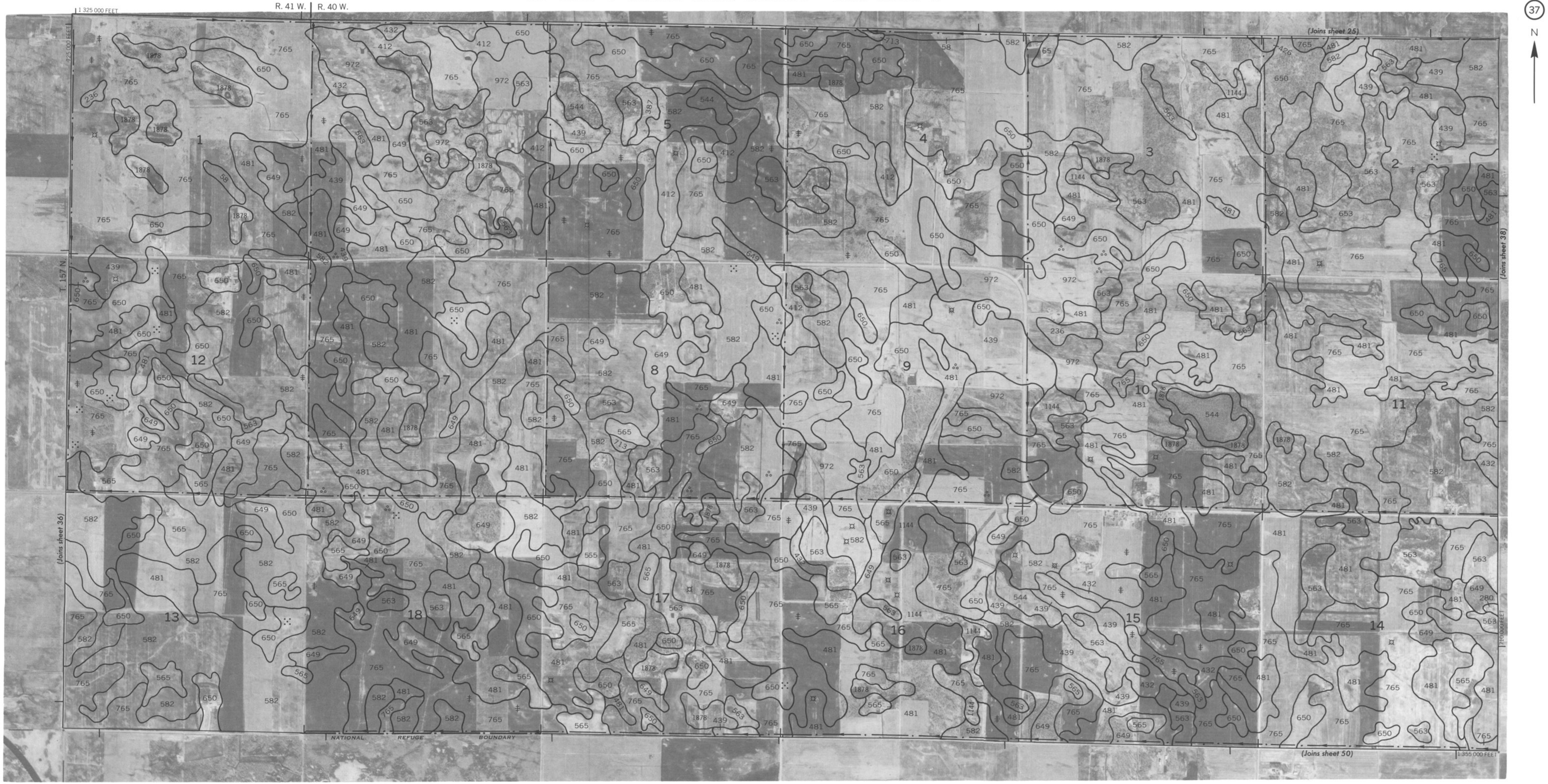
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 34

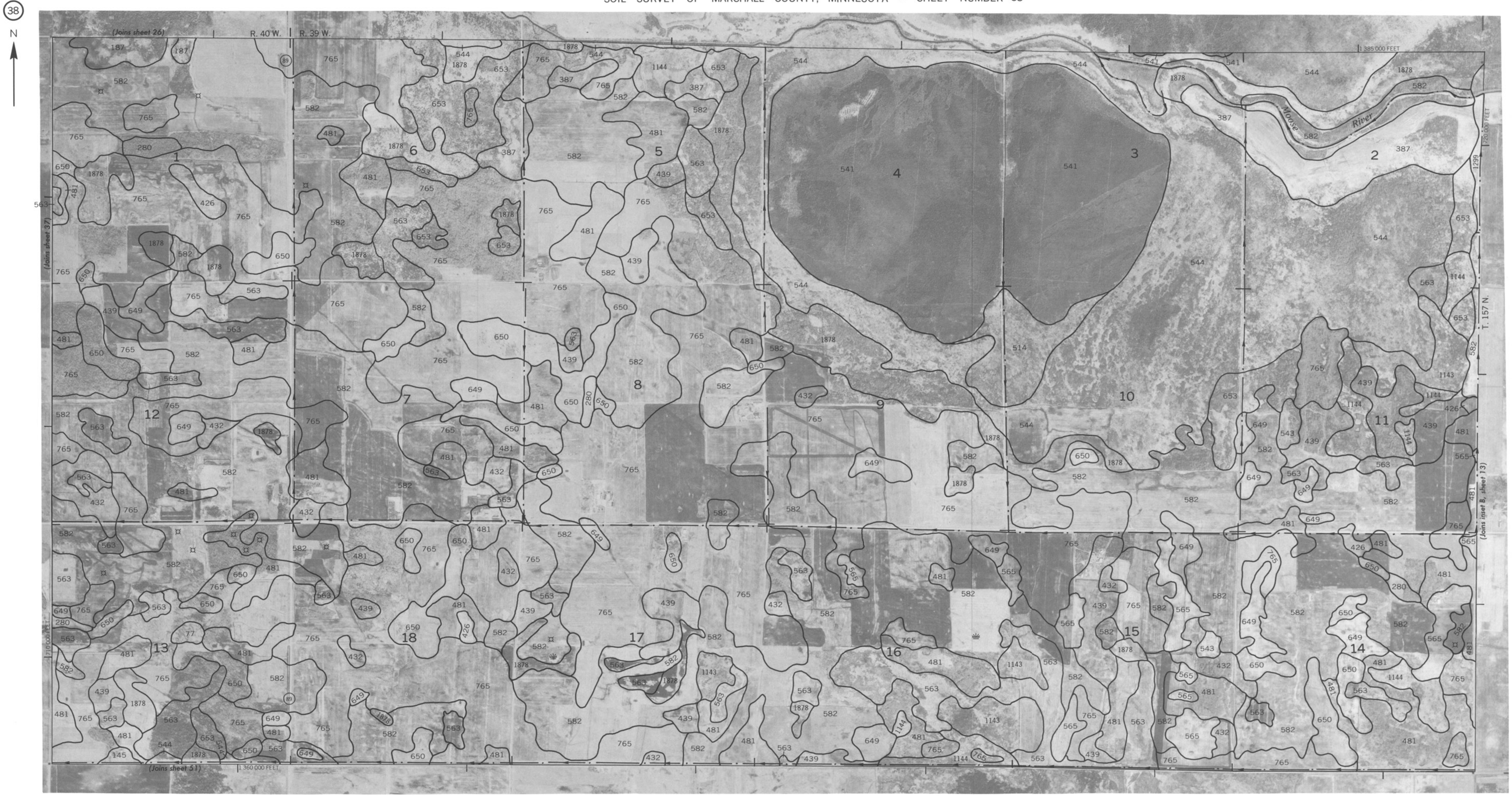

N
(Joins sheet 22)
R. 43 W
1 285 000 FEET
(Joins sheet 33)
T. 157 N.
(Joins sheet 35)
(Joins sheet 47)
1 235 000 FEET
215 000 FEET
MIDDLE RIVER
Middle River
NORTHERN
BURLINGTON
SEWAGE LAGOON
32
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18


N
1 270 000 FEET
R. 42 W.
(Joins sheet 23)
(Joins sheet 36)
(Joins sheet 34)
(Joins sheet 48)
725 000 FEET
T. 157 N.
1 295 000 FEET
BOUNDARY
NATIONAL
REFUGE
AGASSIZ
NATIONAL
WILDLIFE
REFUGE
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18


N
(Joins sheet 24)
R. 41 W.
1 320 000 FEET
725 000 FEET
T. 157 N.
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 49)
715 000 FEET
1 300 000 FEET
Thief River
NATIONAL REFUGE BOUNDARY
AGASSIZ NATIONAL WILDLIFE REFUGE
Tamarack Pool
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18

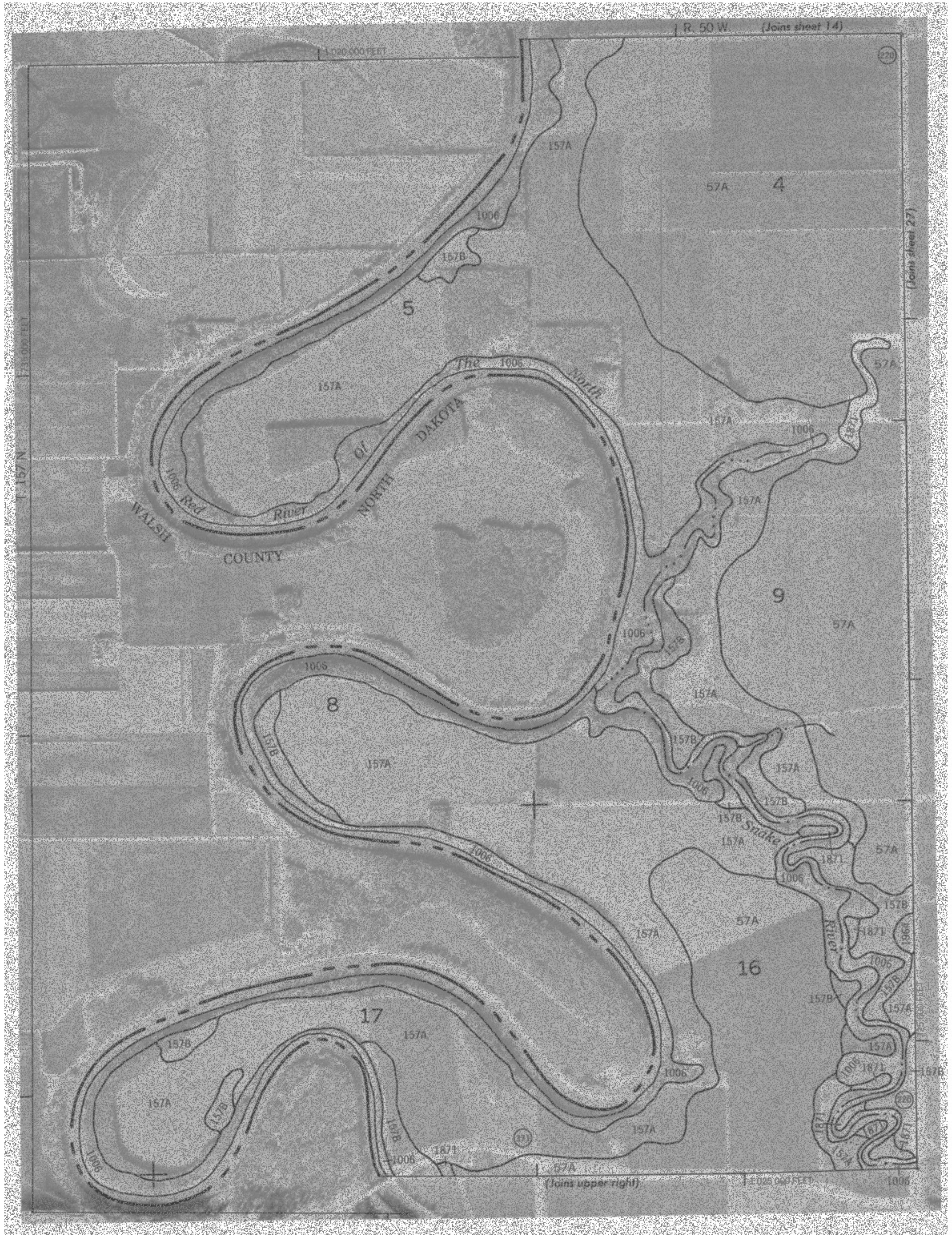
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 37

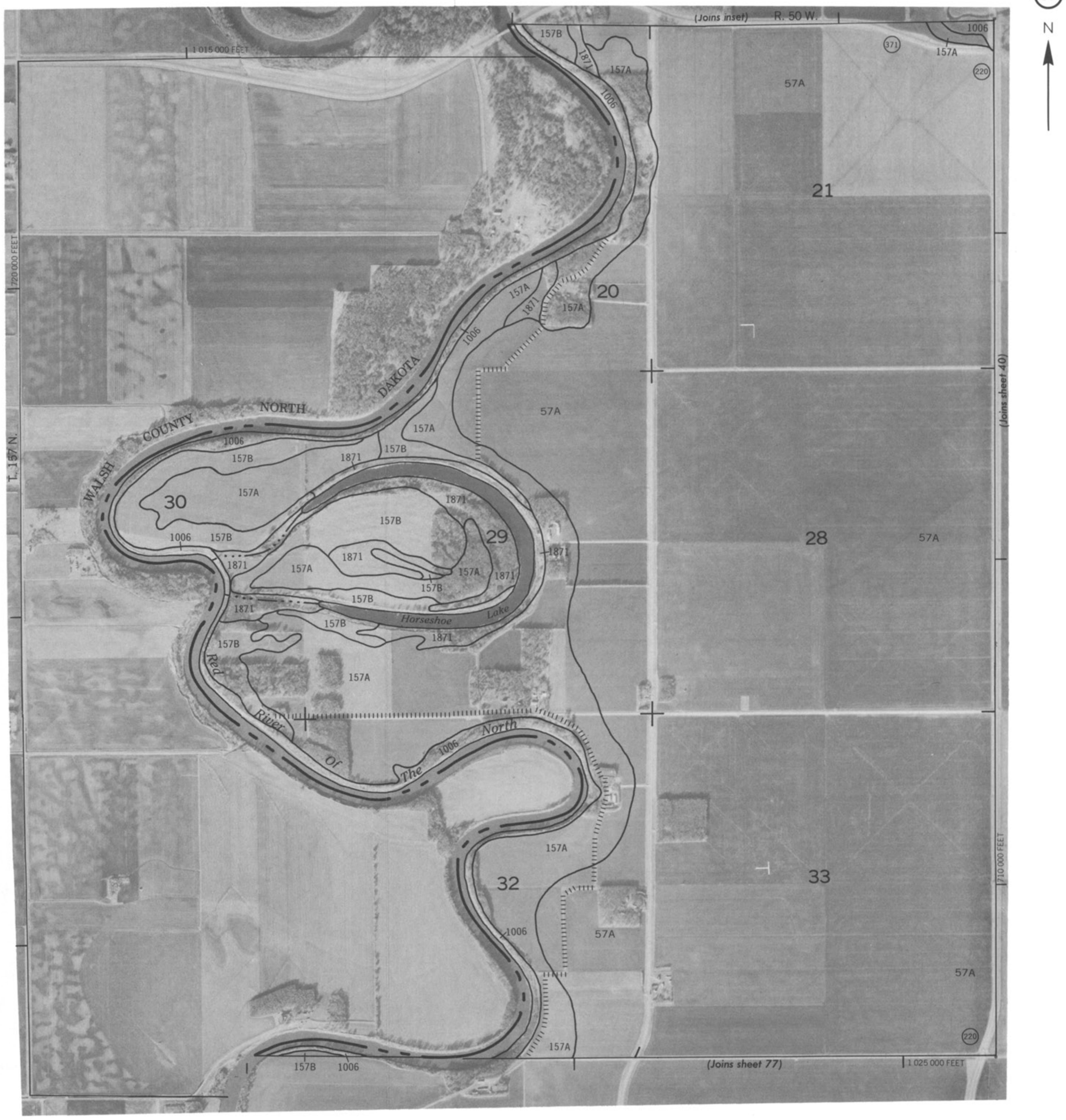

37
N
R. 41 W.
R. 40 W.
T. 157 N.
1 325 000 FEET
728 000 FEET
(Joins sheet 25)
(Joins sheet 38)
(Joins sheet 50)
(Joins sheet 36)
1 355 000 FEET
700 000 FEET
NATIONAL REFUGE BOUNDARY
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

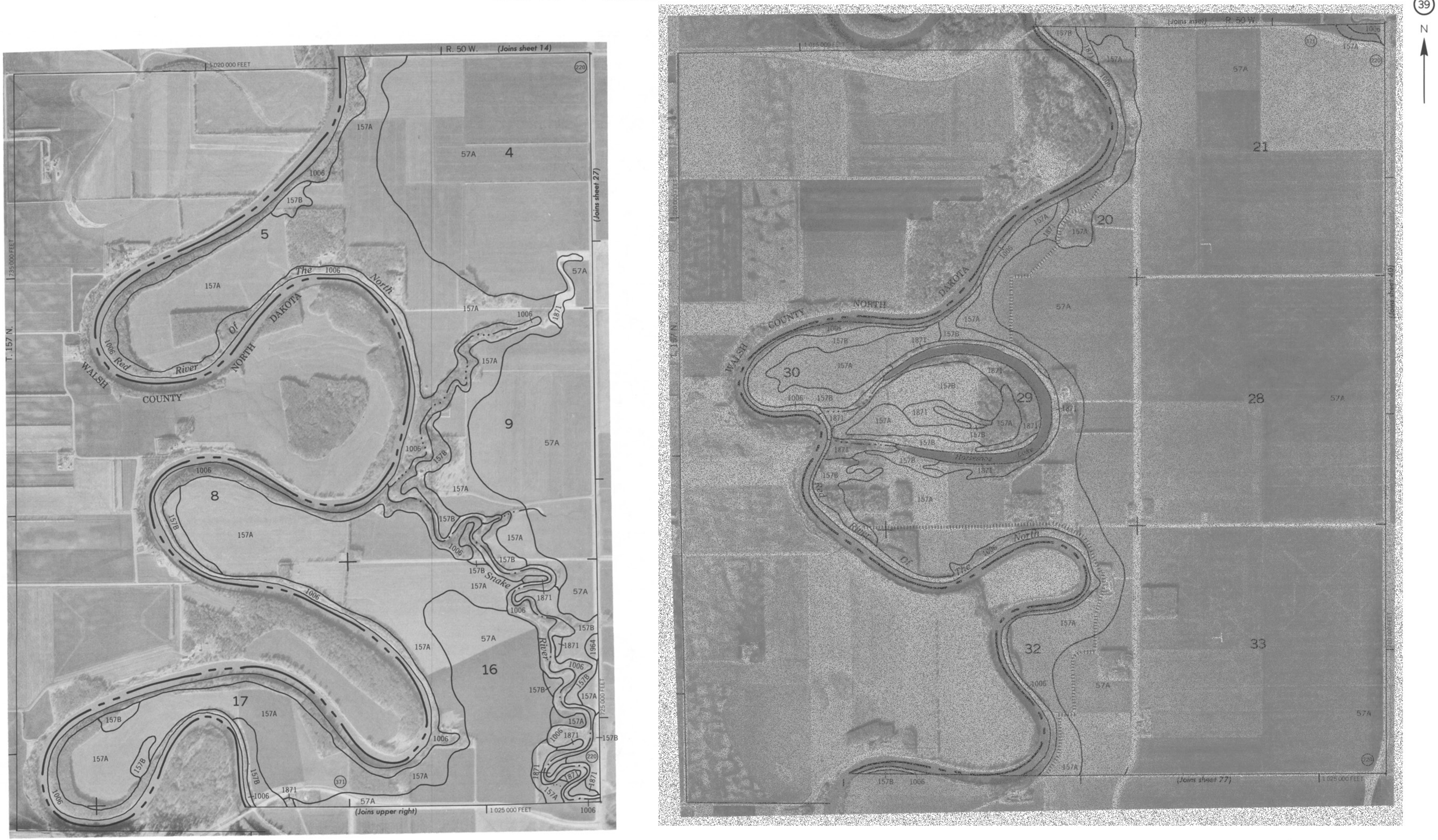

38
N
(Joins sheet 26)
R. 40 W.
R. 39 W.
(Joins sheet 37)
(Joins sheet 51)
(Joins inset B, sheet 13)
T. 157 N.
Moose River
1 385 000 FEET
1 360 000 FEET
720 000 FEET
710 000 FEET
89

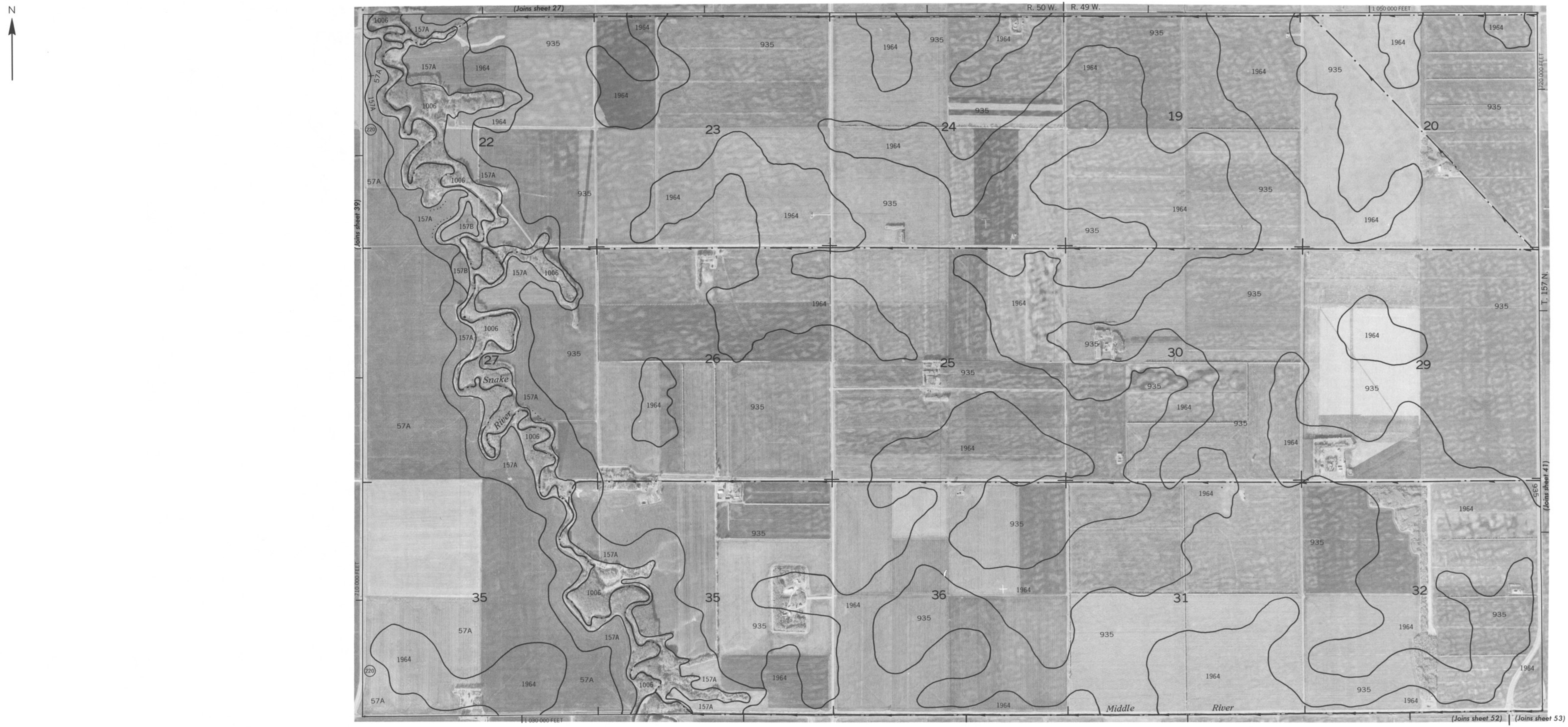
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 39

㊴

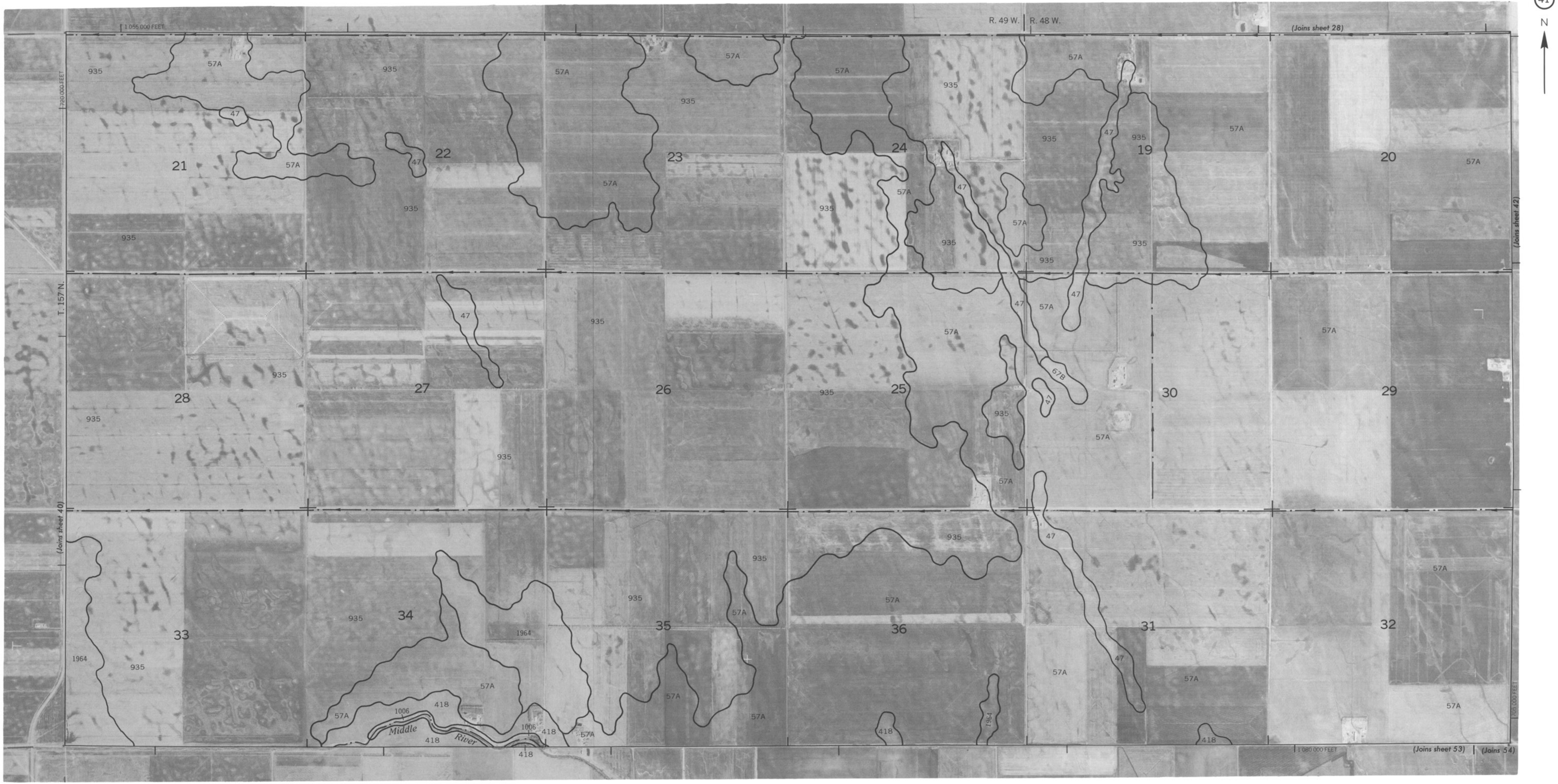

R. 50 W.
(Joins sheet 14)
1 020 000 FEET
220
T. 157 N.
(Joins sheet 27)
4
5
8
9
16
17
57A
157A
157B
1006
1871
The North Dakota
WALSH COUNTY
Red River Of The North
Snake River
(Joins upper right)
1 025 000 FEET
371

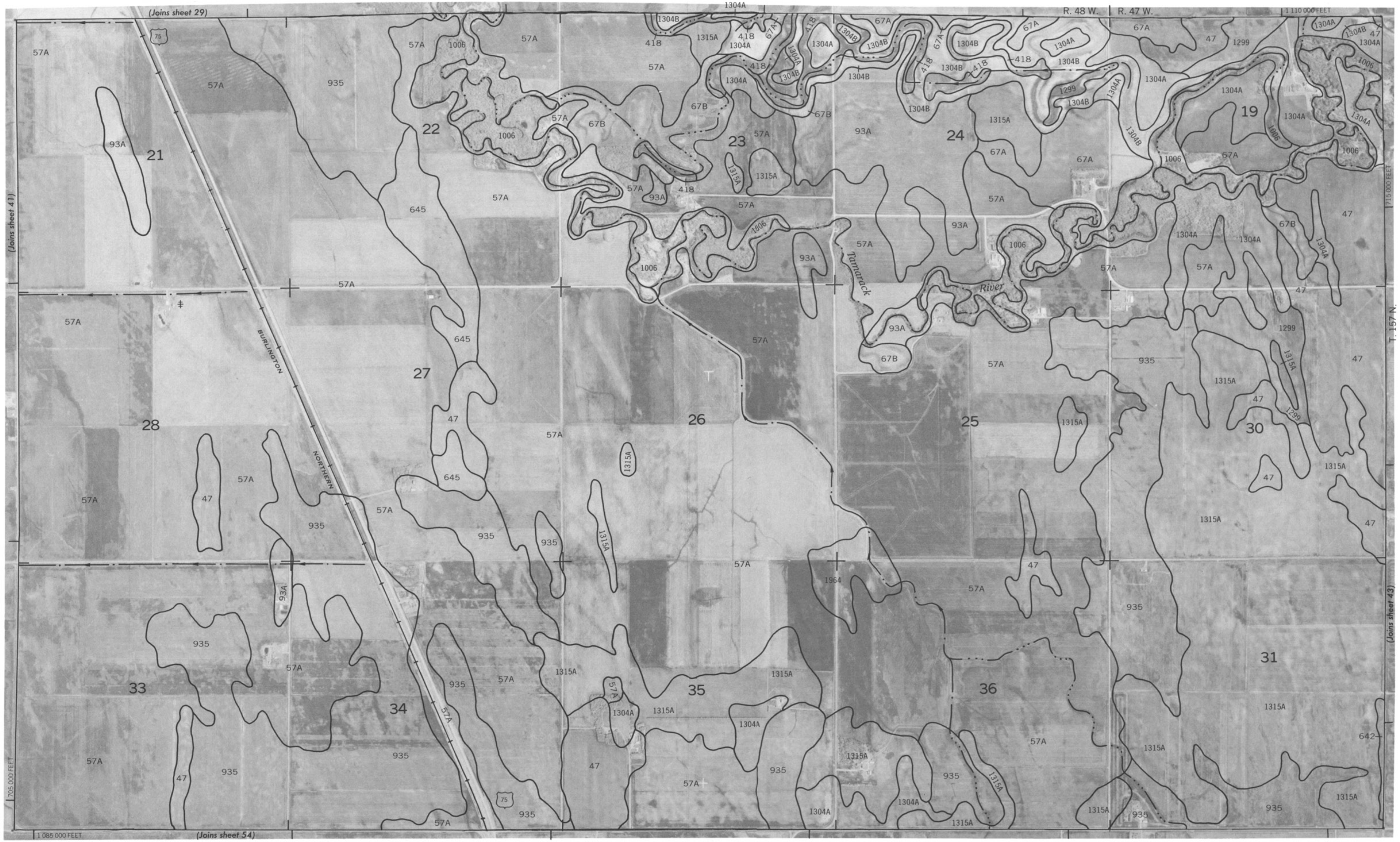

N
(Joins inset)
R. 50 W.
1 015 000 FEET
371
220
T. 157 N.
720 000 FEET
710 000 FEET
(Joins sheet 40)
(Joins sheet 77)
1 025 000 FEET
20
21
28
29
30
32
33
57A
157A
157B
1006
1871
NORTH DAKOTA
WALSH COUNTY
Horseshoe Lake
Red River Of The North


R. 50 W.
(Joins sheet 14)
1 020 000 FEET
220
157A
4
57A
1006
157B
5
(Joins sheet 27)
735 000 FEET
T. 157 N.
The
North
DAKOTA
of
NORTH
Red
River
WALSH
COUNTY
1871
9
8
157B
Snake
River
16
17
1964
371
(Joins upper right)
1 025 000 FEET
39
N
(Joins inset)
21
20
28
29
30
Red
River
Of
The
North
32
33
(Joins sheet 40)
(Joins sheet 77)
720 000 FEET
715 000 FEET

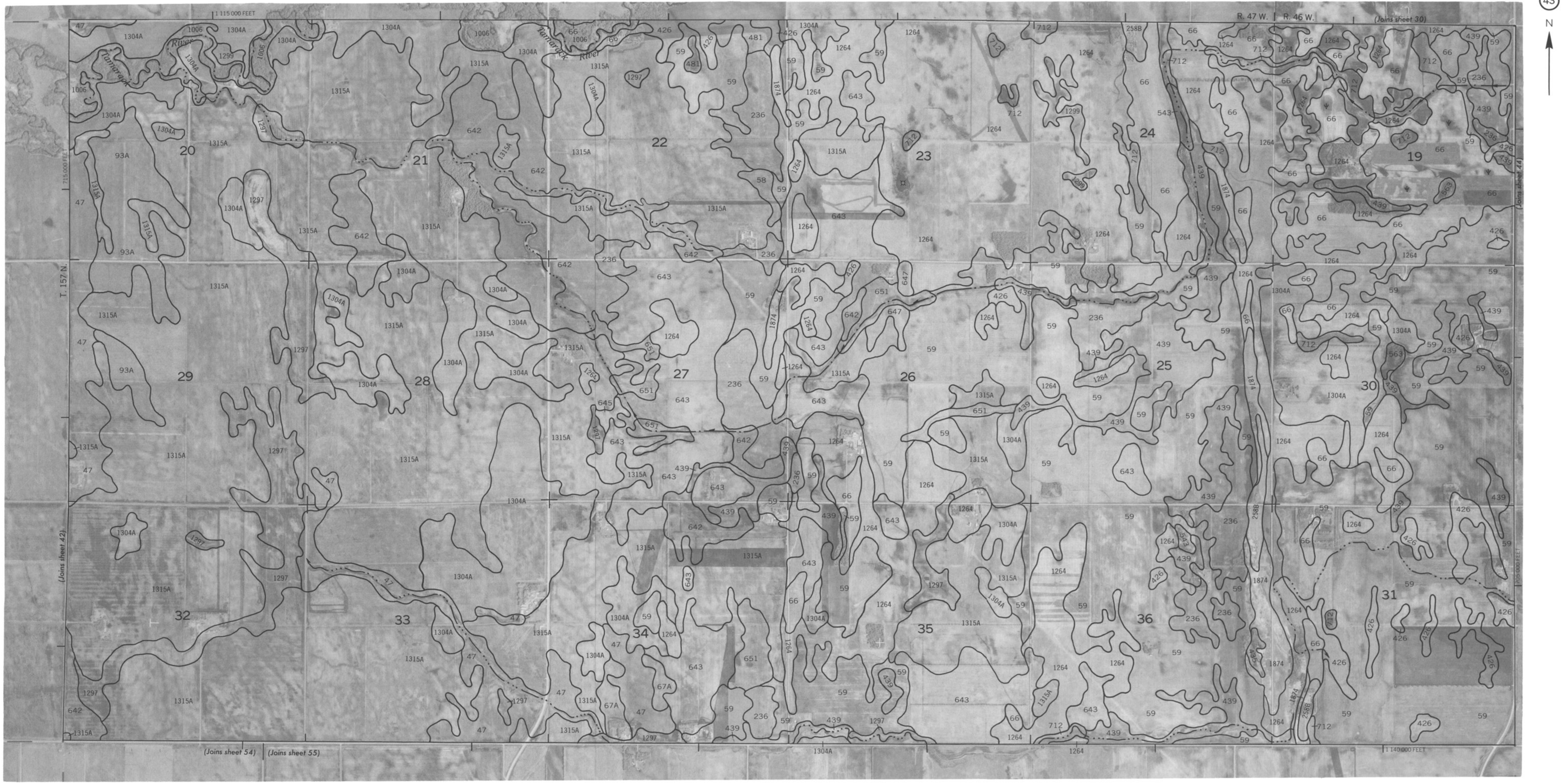

N
(Joins sheet 27)
R. 50 W.
R. 49 W.
1 050 000 FEET
1006
157A
935
1964
57A
220
22
23
24
19
20
935
1964
1 20 000 FEET
(Joins sheet 39)
157B
27
Snake
River
26
25
30
29
T. 157 N.
(Joins sheet 41)
35
36
31
32
710 000 FEET
Middle
River
1 030 000 FEET
(Joins sheet 52)
(Joins sheet 53)

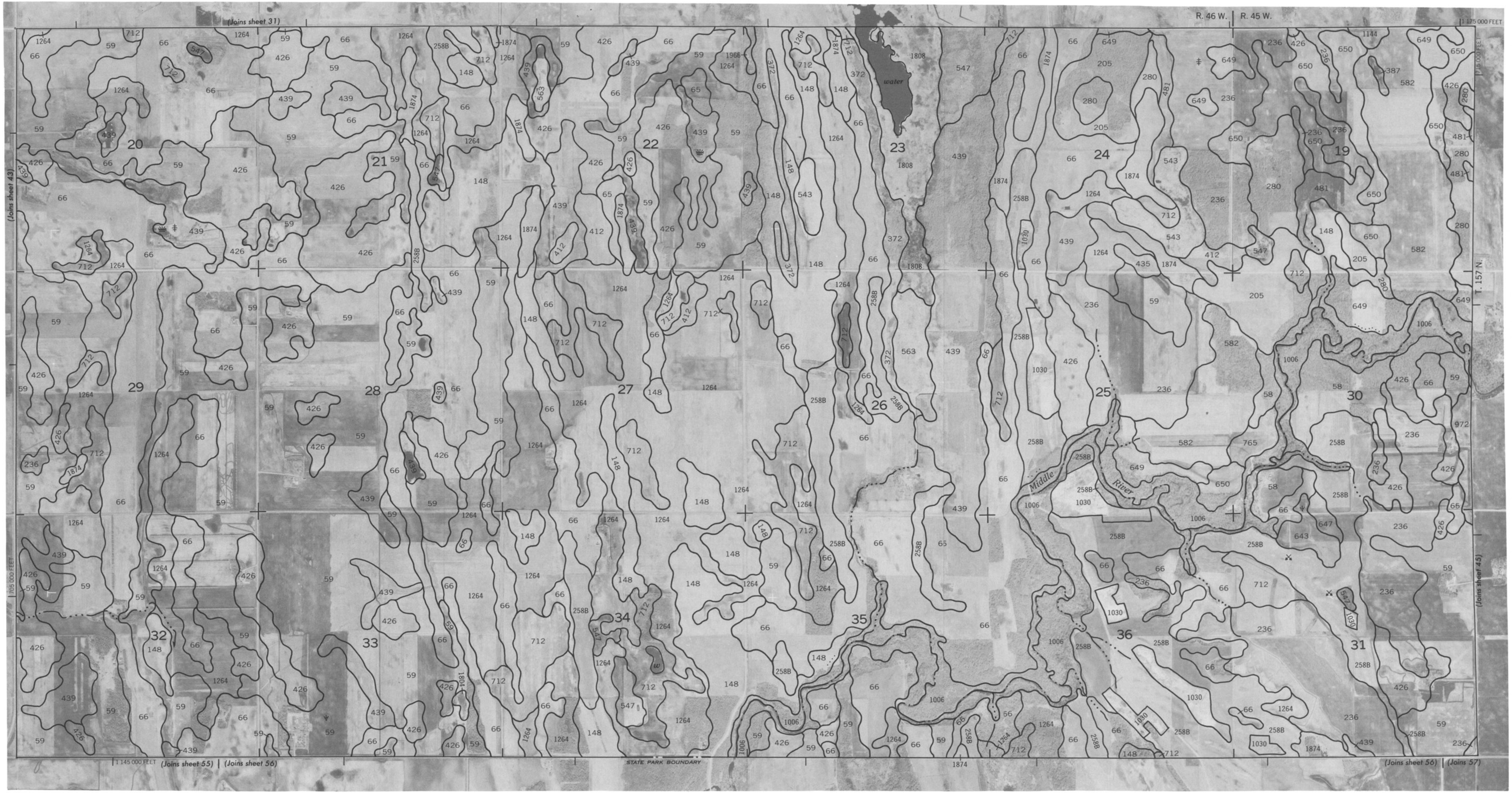
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 41


1 055 000 FEET
R. 49 W.
R. 48 W.
(Joins sheet 28)
N
720 000 FEET
T. 157 N.
(Joins sheet 42)
(Joins sheet 40)
700 000 FEET
1 080 000 FEET
(Joins sheet 53)
(Joins 54)
21
22
23
24
19
20
28
27
26
25
30
29
33
34
35
36
31
32
935
57A
47
67B
1964
1006
418
Middle
River

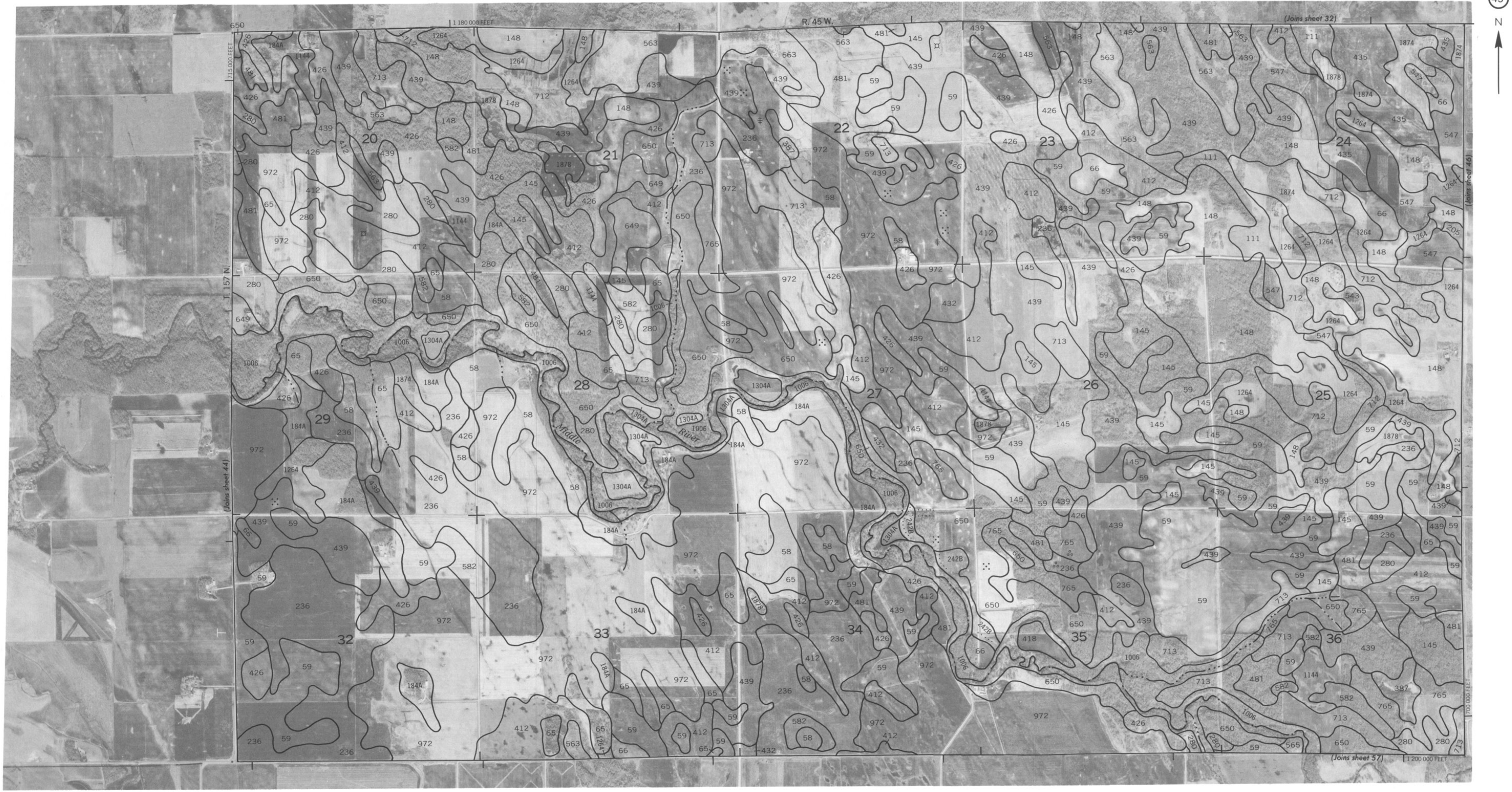

N
(Joins sheet 29)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 54)
R. 48 W.
R. 47 W.
T. 157 N.
1 110 000 FEET
1 085 000 FEET
705 000 FEET
715 000 FEET
BURLINGTON
NORTHERN
75
Tamarack
River
19
21
22
23
24
25
26
27
28
30
31
33
34
35
36
57A
93A
935
645
47
1006
418
1304A
1304B
1315A
67A
67B
1299
1964
642

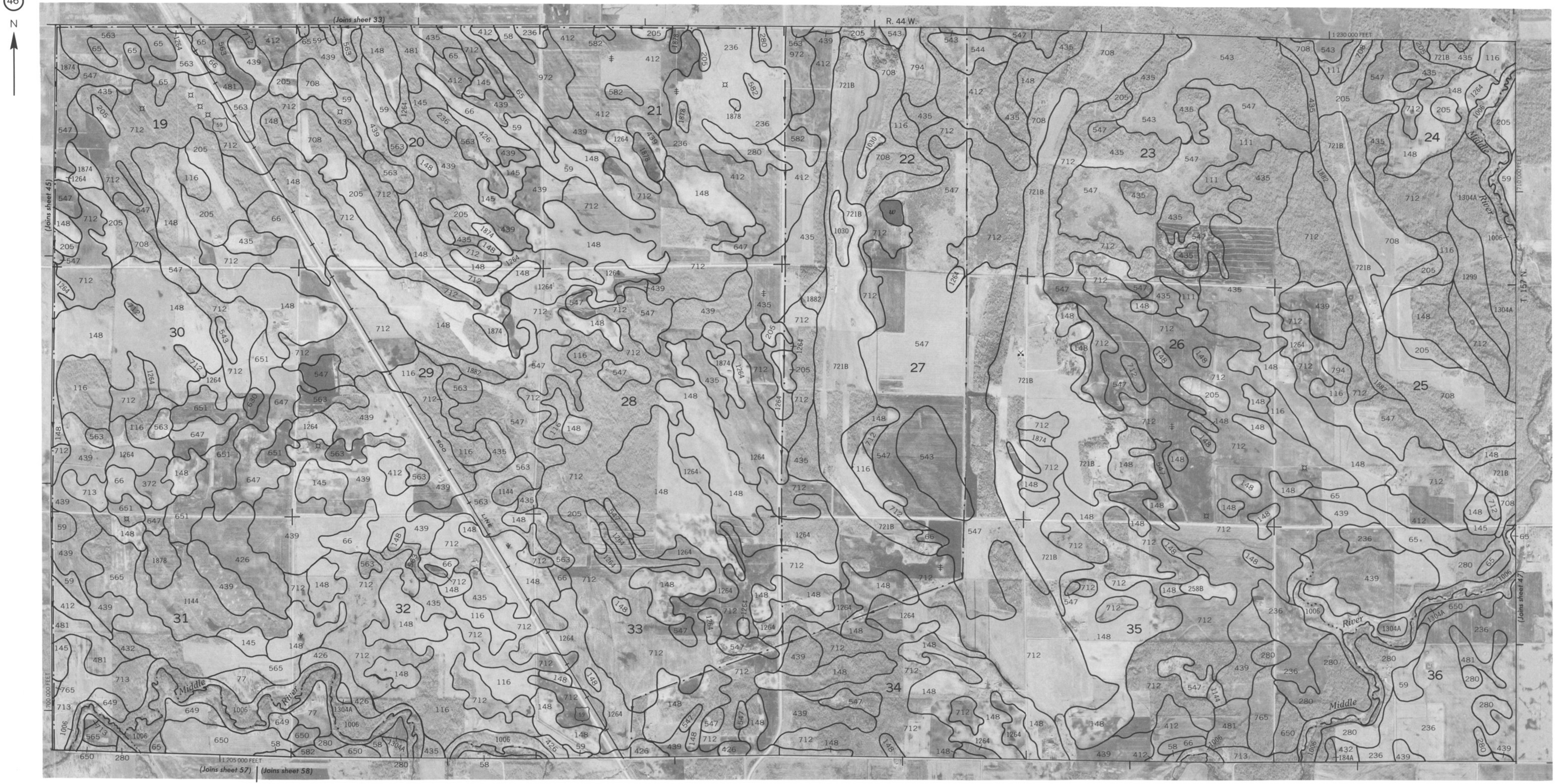
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 43


N
1 115 000 FEET
R. 47 W.
R. 46 W.
(Joins sheet 30)
(Joins sheet 44)
(Joins sheet 42)
(Joins sheet 54)
(Joins sheet 55)
T. 157 N.
715 000 FEET
705 000 FEET
1 140 000 FEET
Tamarack River
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

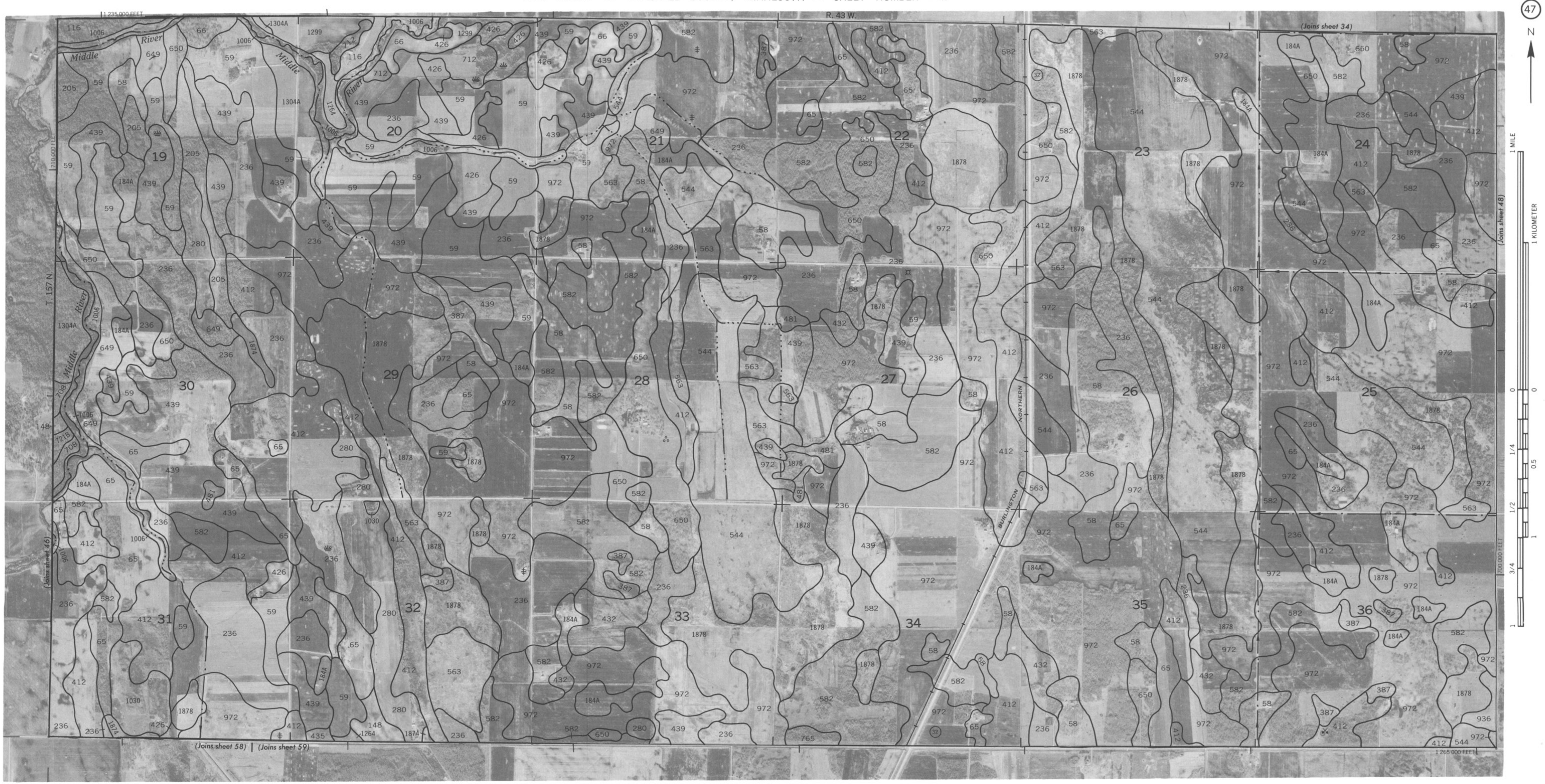

N
(Joins sheet 31)
R. 46 W.
R. 45 W.
1 175 000 FEET
(Joins sheet 43)
(Joins sheet 45)
T. 157 N.
705 000 FEET
1 145 000 FEET
(Joins sheet 55)
(Joins sheet 56)
STATE PARK BOUNDARY
(Joins sheet 56)
(Joins 57)
water
Middle River
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

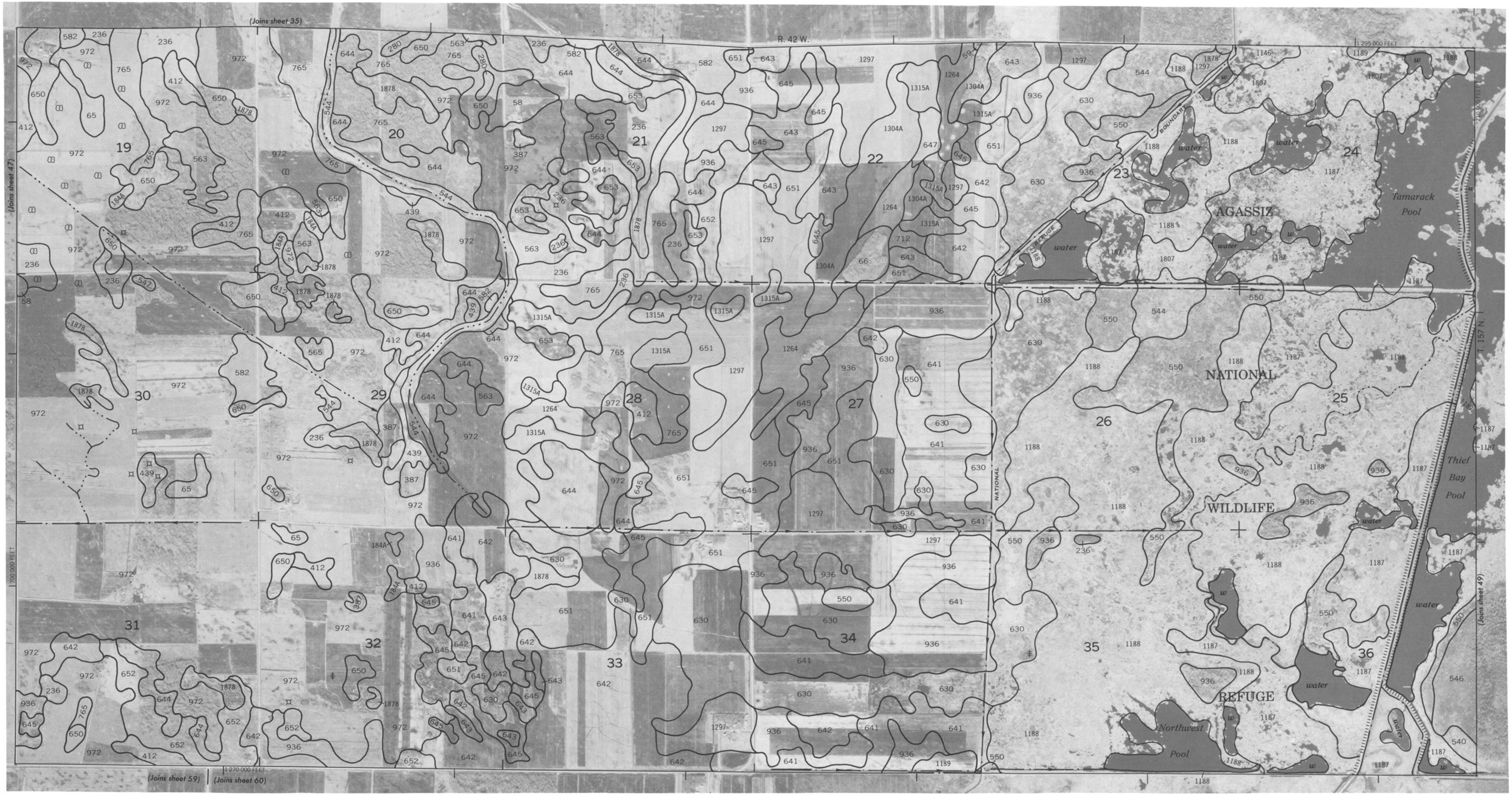
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 45

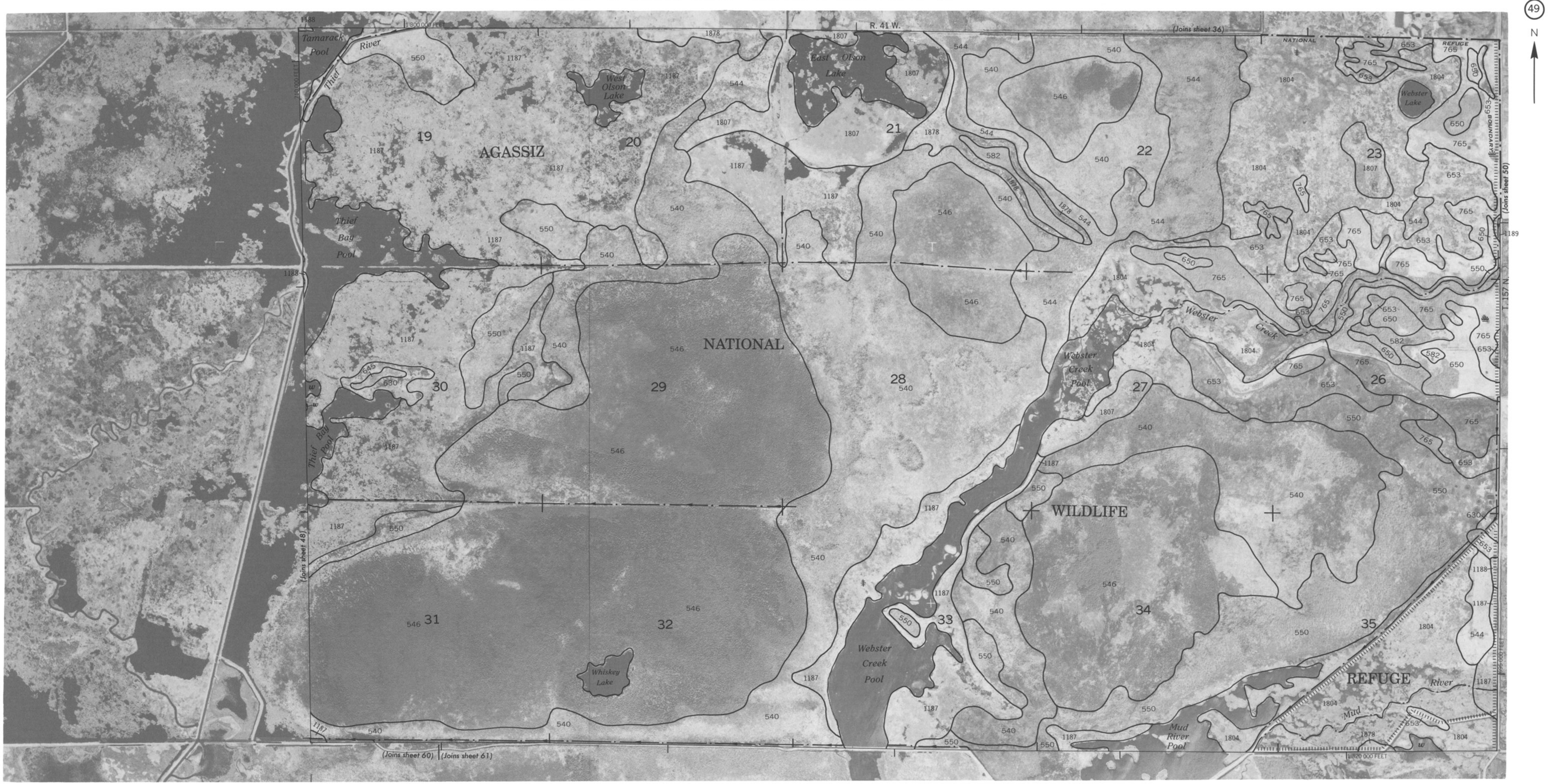

N
R. 45 W.
T. 157 N.
1 180 000 FEET
1 200 000 FEET
715 000 FEET
700 000 FEET
650
(Joins sheet 32)
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 57)
Middle River
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

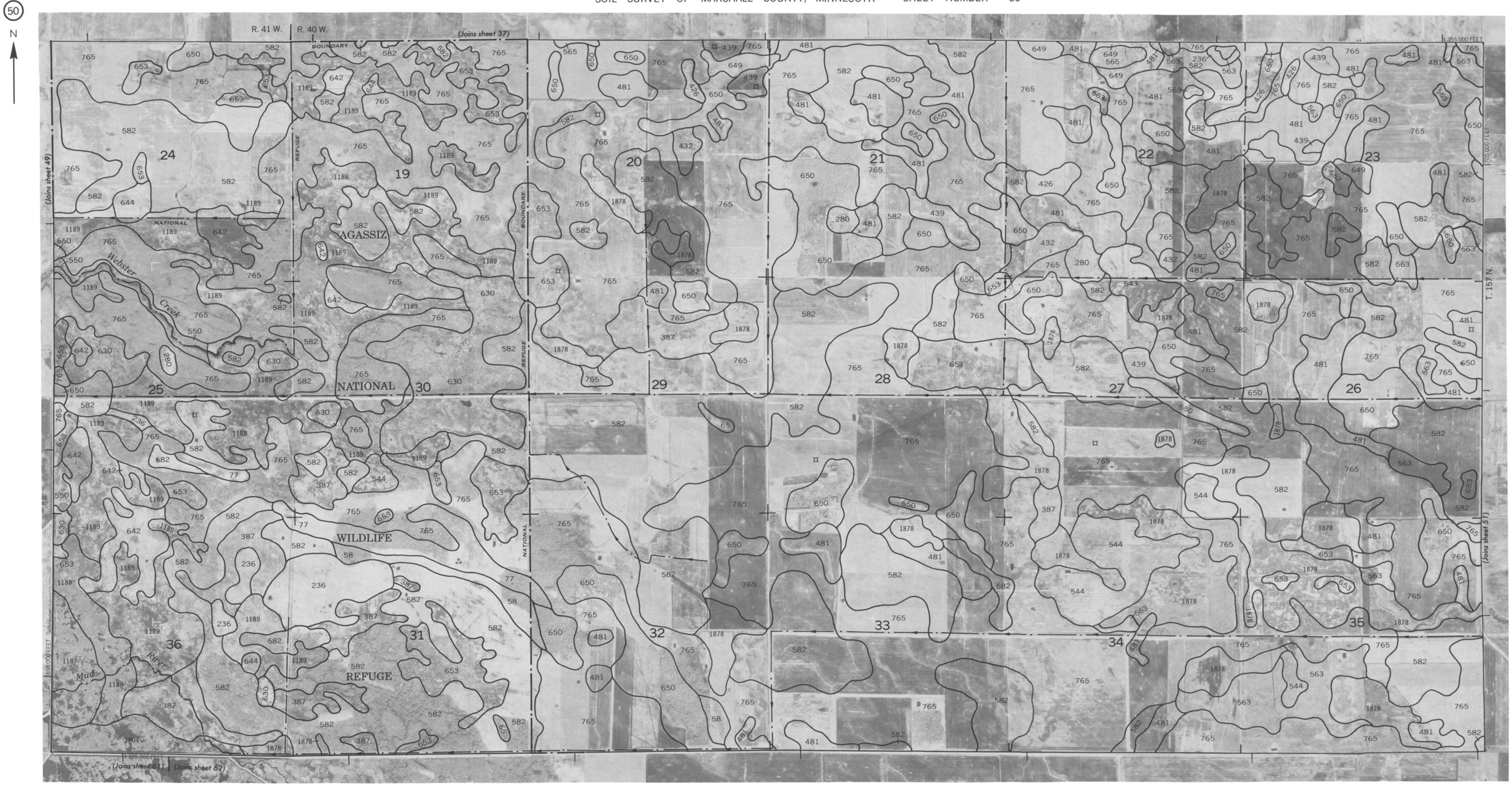

N
(Joins sheet 33)
R. 44 W.
1 230 000 FEET
(Joins sheet 45)
(Joins sheet 47)
T. 157 N.
710 000 FEET
700 000 FEET
1 205 000 FEET
(Joins sheet 57)
(Joins sheet 58)
SOO LINE
Middle River
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 47

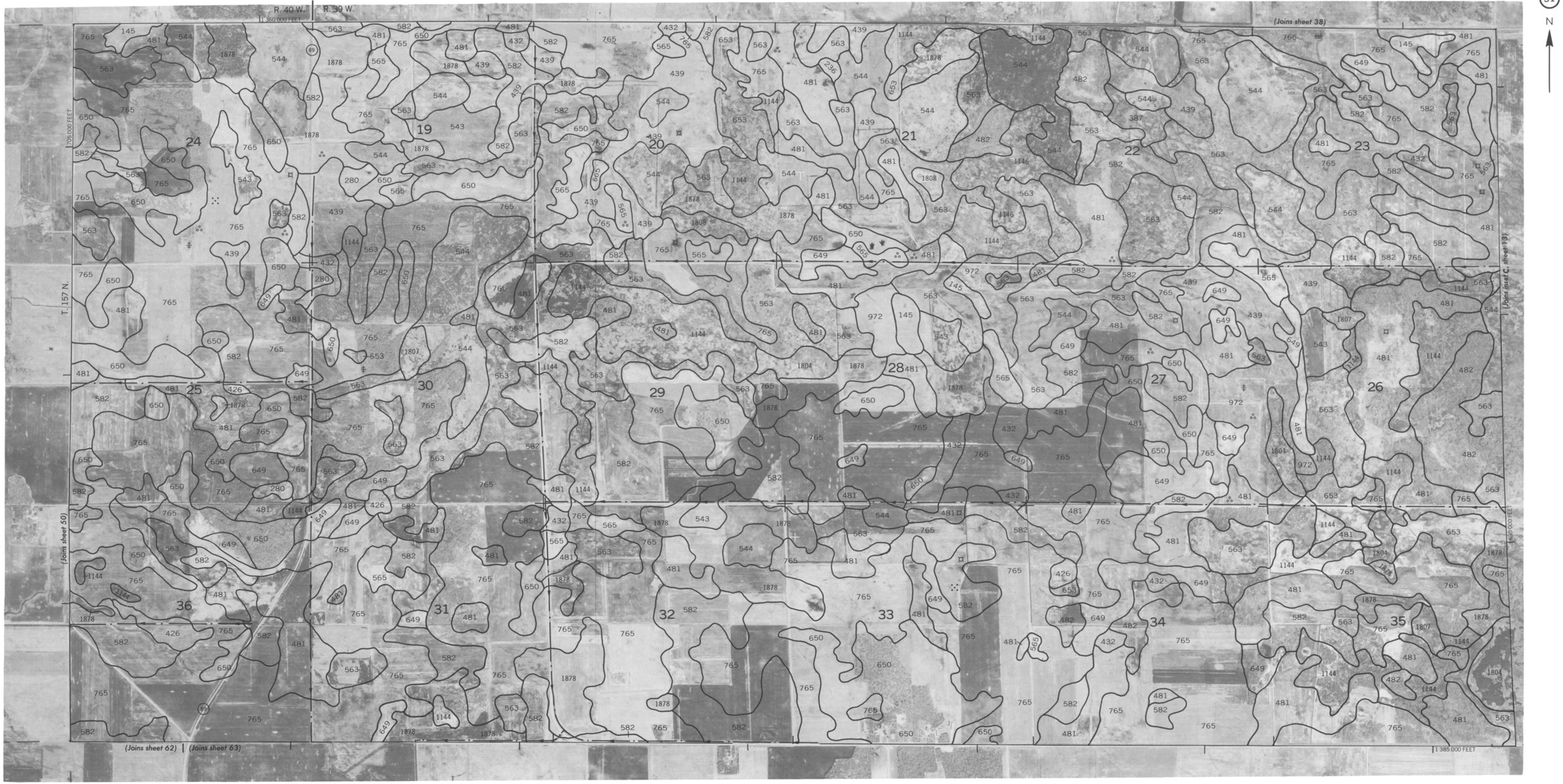

47
N
R. 43 W.
T. 157 N.
1 235 000 FEET
1 265 000 FEET
710 000 FEET
700 000 FEET
(Joins sheet 34)
(Joins sheet 48)
(Joins sheet 46)
(Joins sheet 58)
(Joins sheet 59)
Middle River
BURLINGTON NORTHERN
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0.5

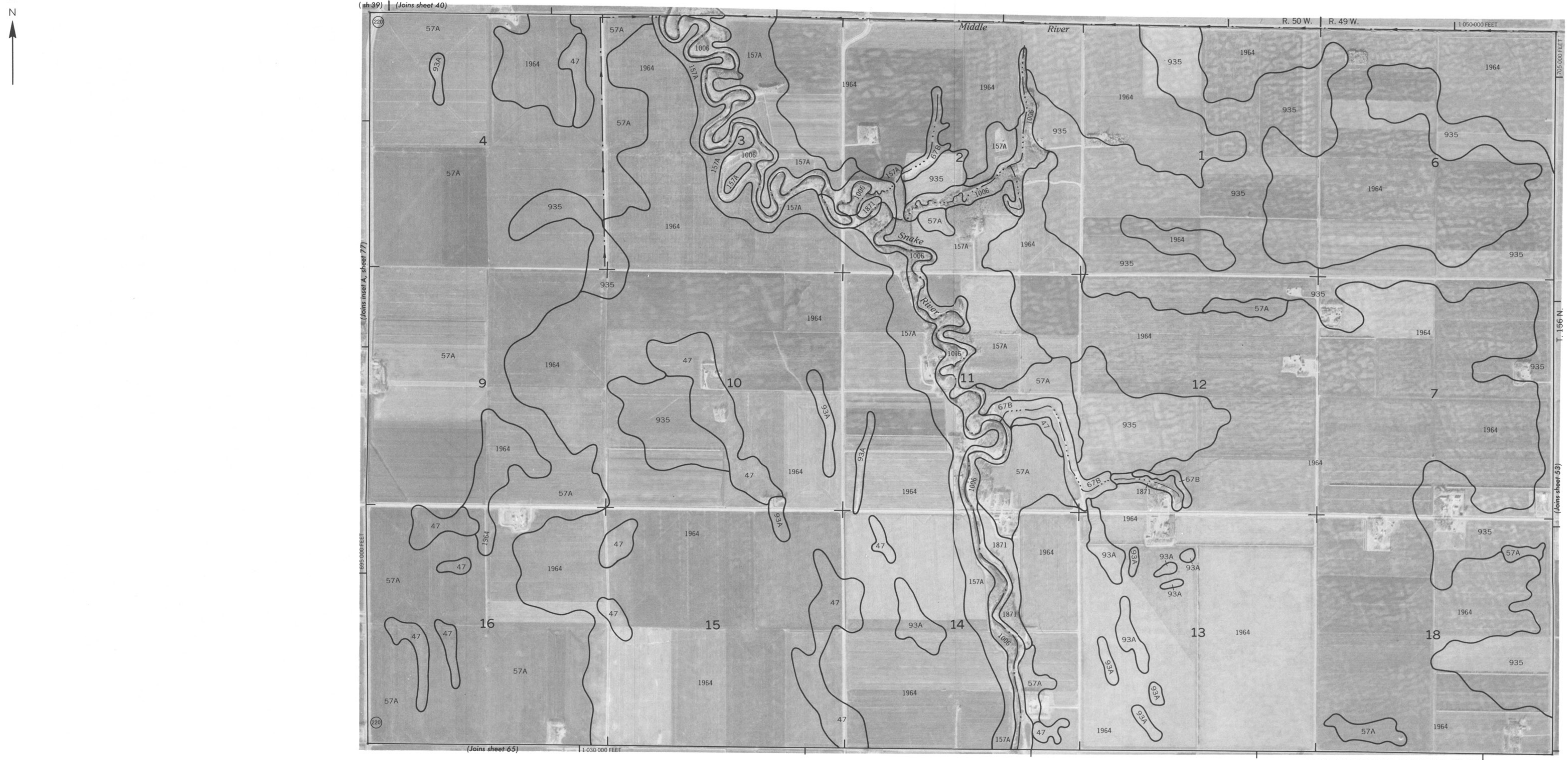

N
(Joins sheet 35)
R. 42 W.
1 295 000 FEET
(Joins sheet 47)
(Joins sheet 49)
T. 157 N.
700 000 FEET
(Joins sheet 59)
(Joins sheet 60)
1 270 000 FEET
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
AGASSIZ
NATIONAL
WILDLIFE
REFUGE
BOUNDARY
Tamarack Pool
Thief Bay Pool
Northwest Pool
water
w

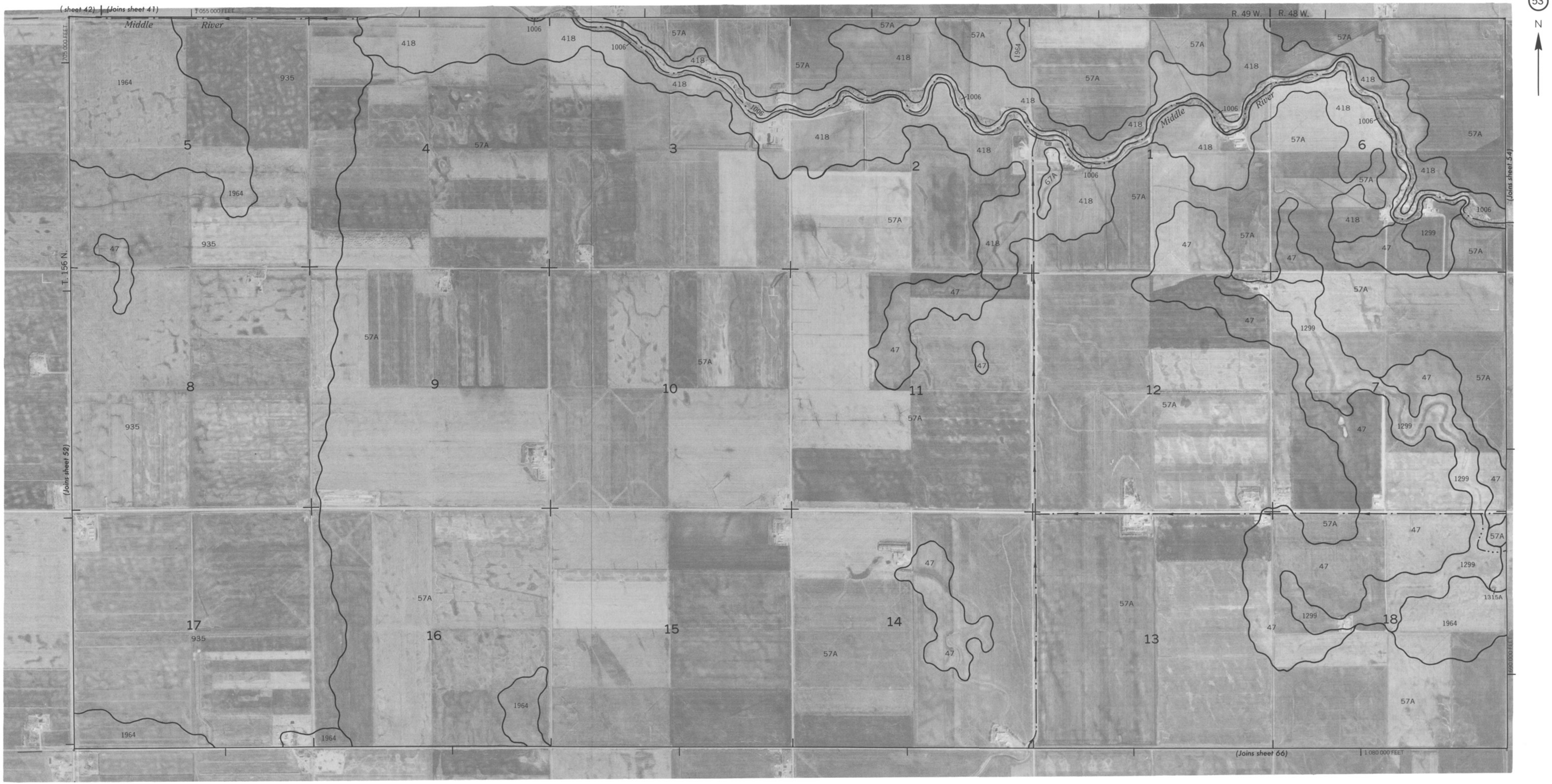

49
N
R. 41 W.
T. 157 N.
(Joins sheet 36)
(Joins sheet 50)
(Joins sheet 48)
(Joins sheet 60)
(Joins sheet 61)
1 300 000 FEET
1 320 000 FEET
AGASSIZ
NATIONAL
WILDLIFE
REFUGE
Tamarack Pool
Thief River
West Olson Lake
East Olson Lake
Thief Bay Pool
Webster Lake
Webster Creek
Webster Creek Pool
Whiskey Lake
Mud River
Mud River Pool
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
540
544
546
550
582
630
645
650
653
765
1187
1188
1189
1804
1807
1878

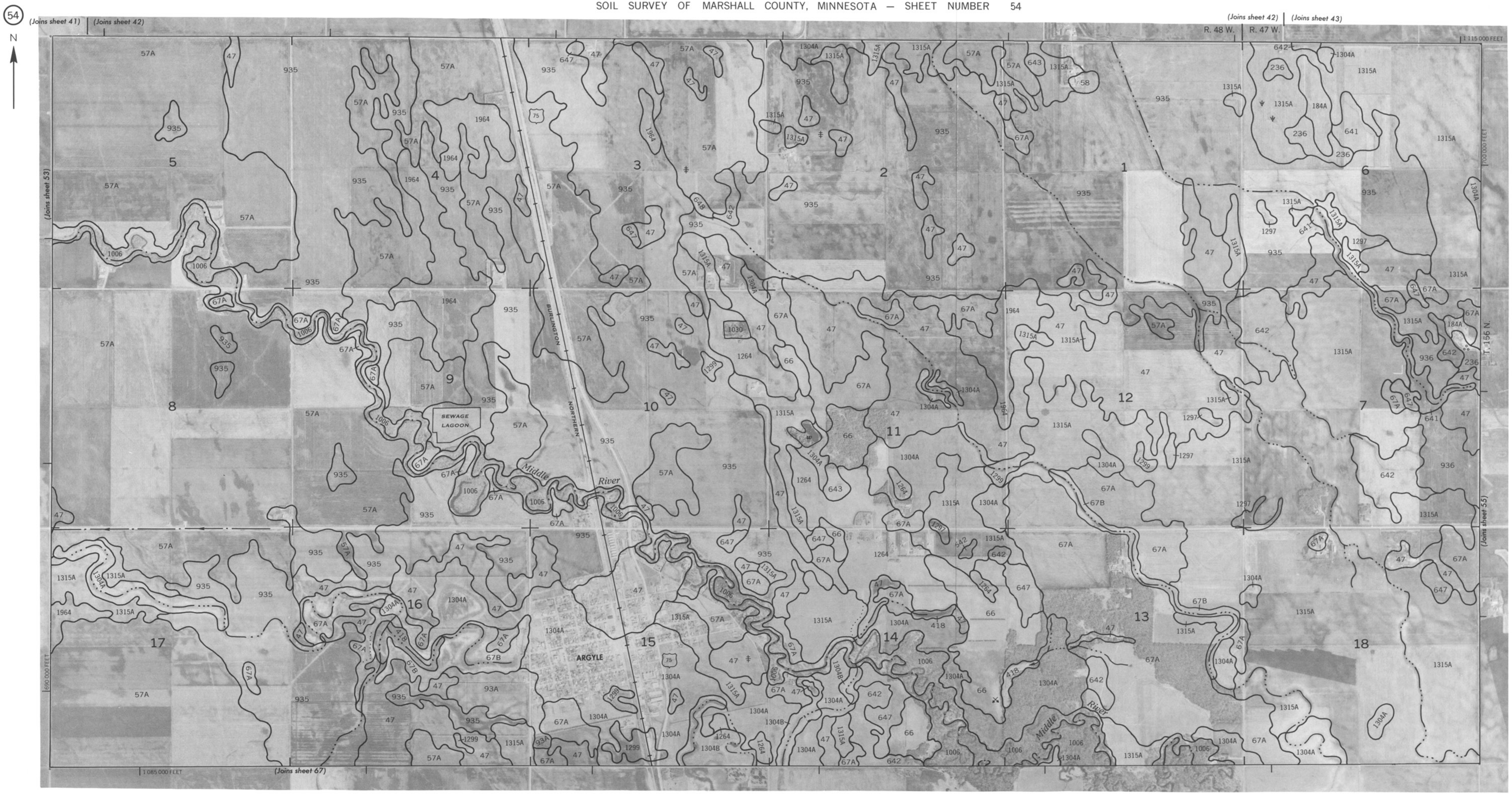

50
N
R. 41 W.
R. 40 W.
(Joins sheet 37)
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 61)
(Joins sheet 62)
T. 157 N.
1 355 000 FEET
705 000 FEET
1 325 000 FEET
698 000 FEET
BOUNDARY
REFUGE
NATIONAL
AGASSIZ
NATIONAL
WILDLIFE
REFUGE
Webster Creek
Mud River
24
19
20
21
22
23
25
30
29
28
27
26
36
31
32
33
34
35

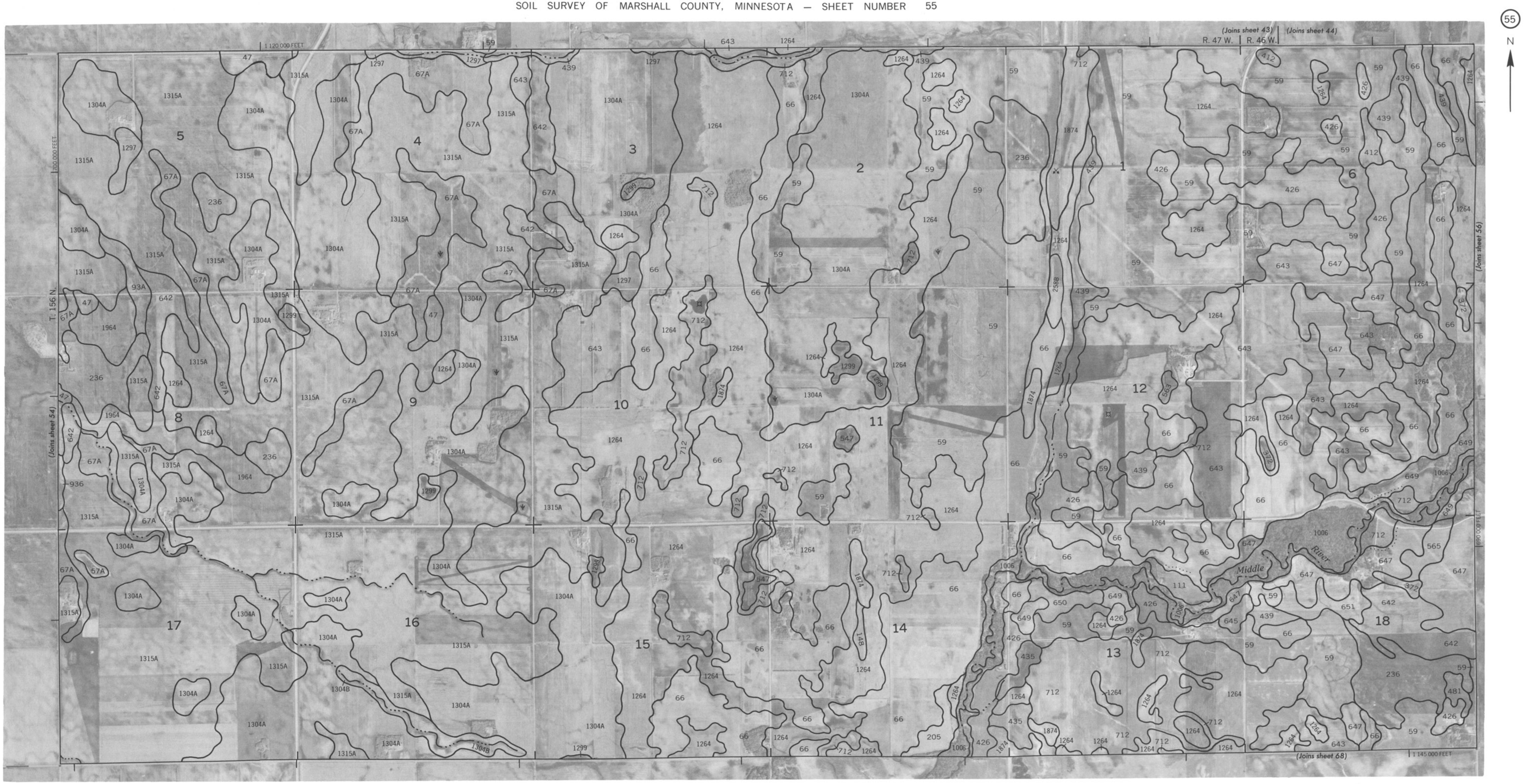
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 51


N
R. 40 W.
R. 39 W.
1 360 000 FEET
705 000 FEET
T. 157 N.
(Joins sheet 38)
(Joins inset C, sheet 13)
(Joins sheet 50)
(Joins sheet 62)
(Joins sheet 63)
685 000 FEET
1 385 000 FEET
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
89
59

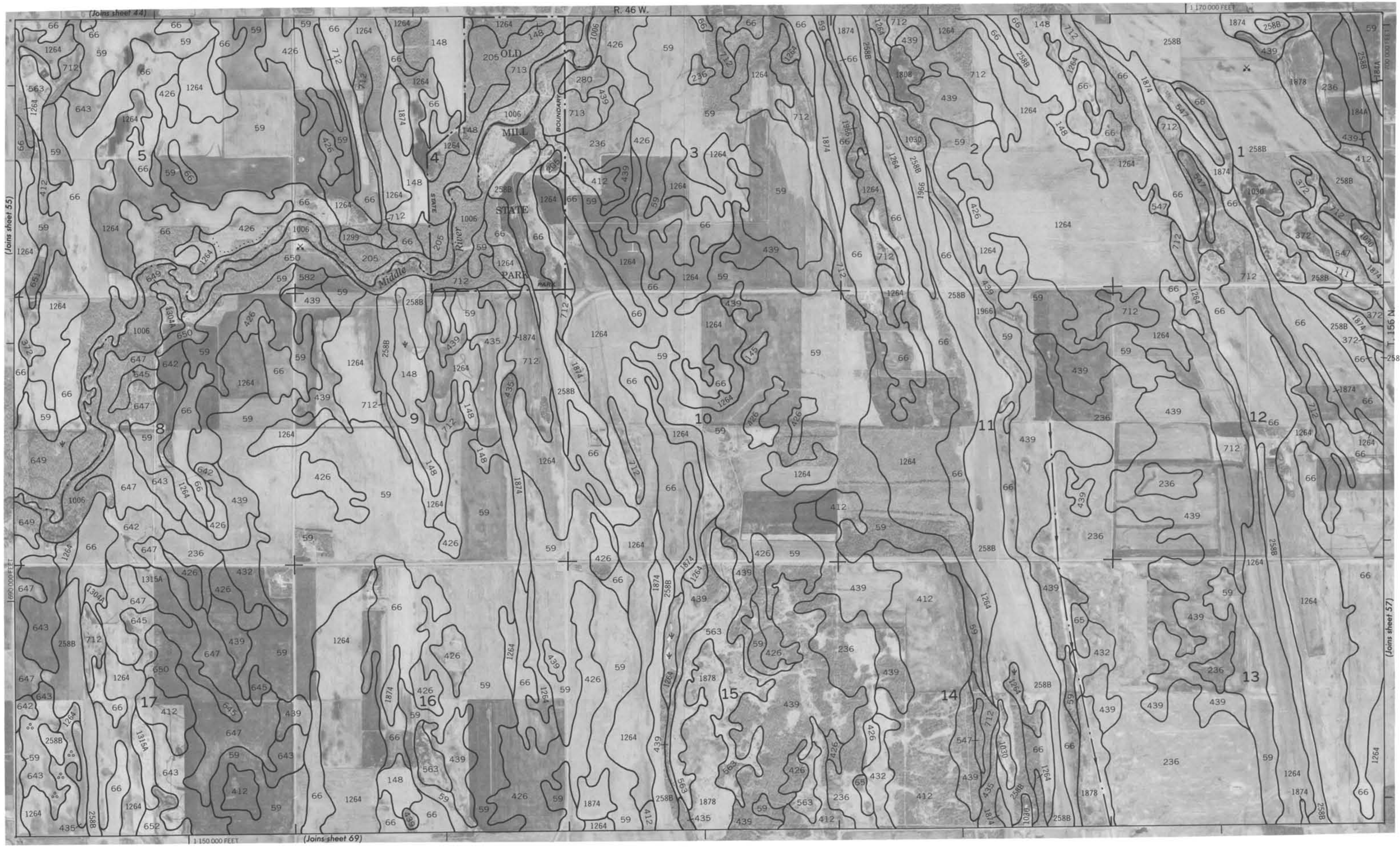

N
(sh 39)
(Joins sheet 40)
Middle River
R. 50 W.
R. 49 W.
1 050 000 FEET
705 000 FEET
T. 156 N.
(Joins sheet 53)
(Joins inset A, sheet 77)
695 000 FEET
(Joins sheet 65)
1 030 000 FEET
220
Snake River
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18
57A
93A
1964
47
935
1006
157A
67B
1871


53
N
(sheet 42)
(Joins sheet 41)
1 055 000 FEET
705 000 FEET
Middle
River
R. 49 W.
R. 48 W.
T. 156 N.
(Joins sheet 52)
(Joins sheet 54)
(Joins sheet 66)
1 080 000 FEET
1 690 000 FEET
1964
935
5
4
3
2
1
6
418
1006
57A
47
67A
1299
8
9
10
11
12
7
17
16
15
14
13
18
1315A

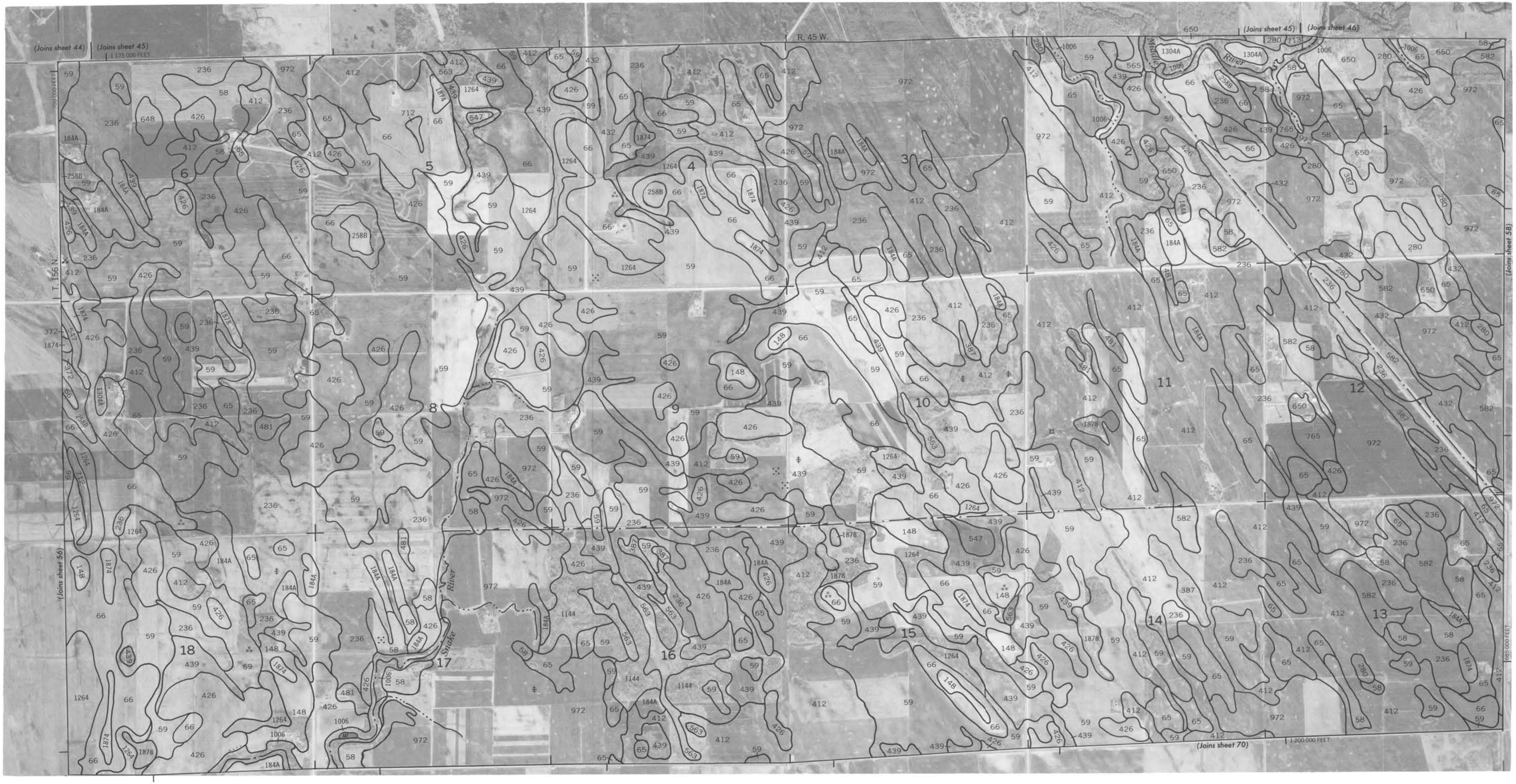

54
N
(Joins sheet 41)
(Joins sheet 42)
(Joins sheet 42)
(Joins sheet 43)
R. 48 W.
R. 47 W.
1 115 000 FEET
700 000 FEET
T. 156 N.
(Joins sheet 53)
(Joins sheet 55)
(Joins sheet 67)
690 000 FEET
1 085 000 FEET
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
75
BURLINGTON
NORTHERN
SEWAGE LAGOON
Middle River
Middle River
ARGYLE


55
N
(Joins sheet 43)
(Joins sheet 44)
R. 47 W.
R. 46 W.
T. 156 N.
(Joins sheet 54)
(Joins sheet 56)
(Joins sheet 68)
1 120 000 FEET
700 000 FEET
680 000 FEET
1 145 000 FEET
Middle River
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 56


N
(Joins sheet 44)
R. 46 W.
1 170 000 FEET
(Joins sheet 55)
T. 156 N.
(Joins sheet 57)
690 000 FEET
1 150 000 FEET
(Joins sheet 69)
OLD MILL STATE PARK
BOUNDARY
STATE PARK
Middle River
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 57


(Joins sheet 44)
(Joins sheet 45)
1 175 000 FEET
700 000 FEET
R. 45 W.
(Joins sheet 45)
(Joins sheet 46)
Middle River
(Joins sheet 58)
T. 156 N.
(Joins sheet 56)
Snake River
(Joins sheet 70)
1 200 000 FEET
685 000 FEET
1
2
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9
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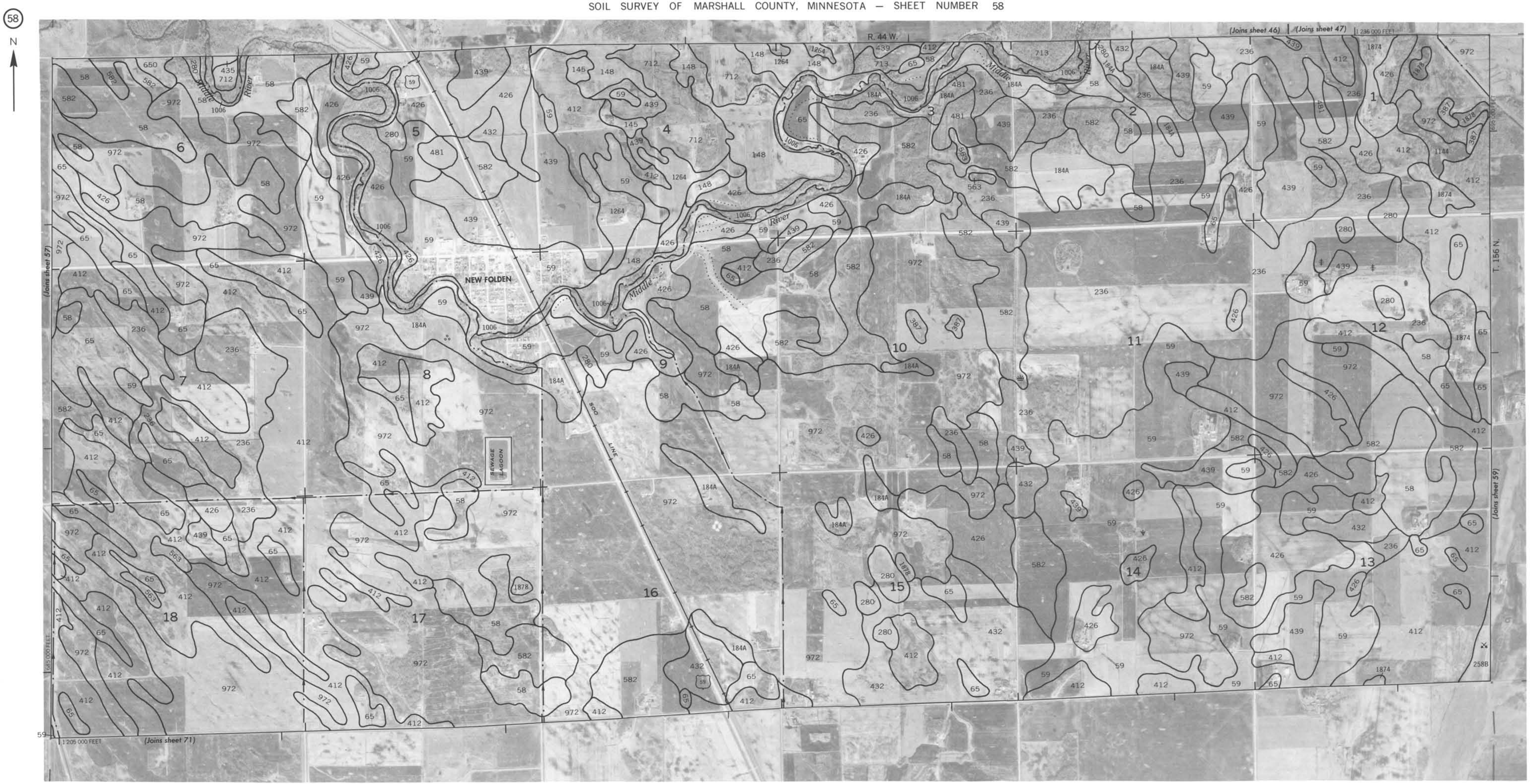
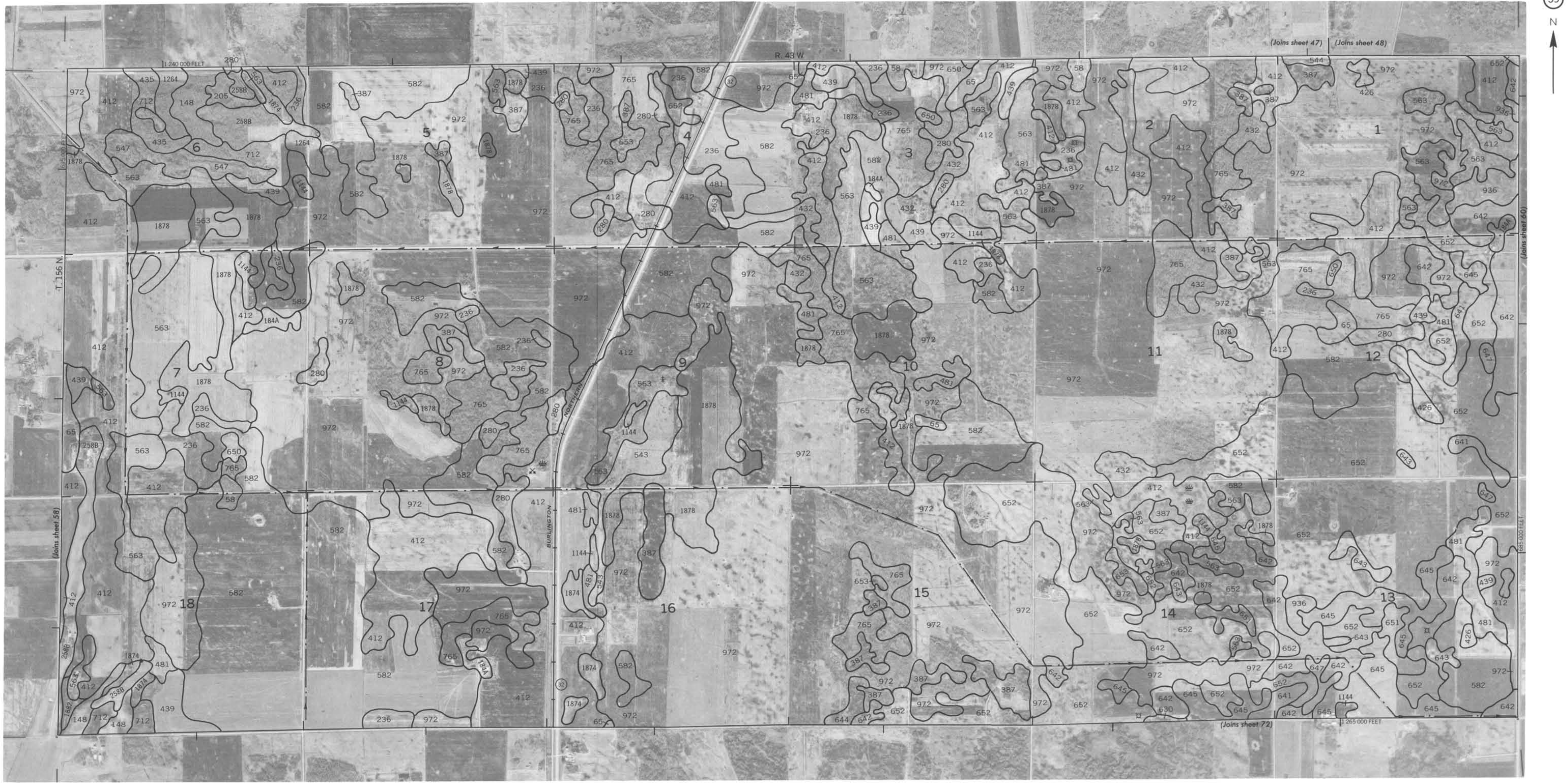
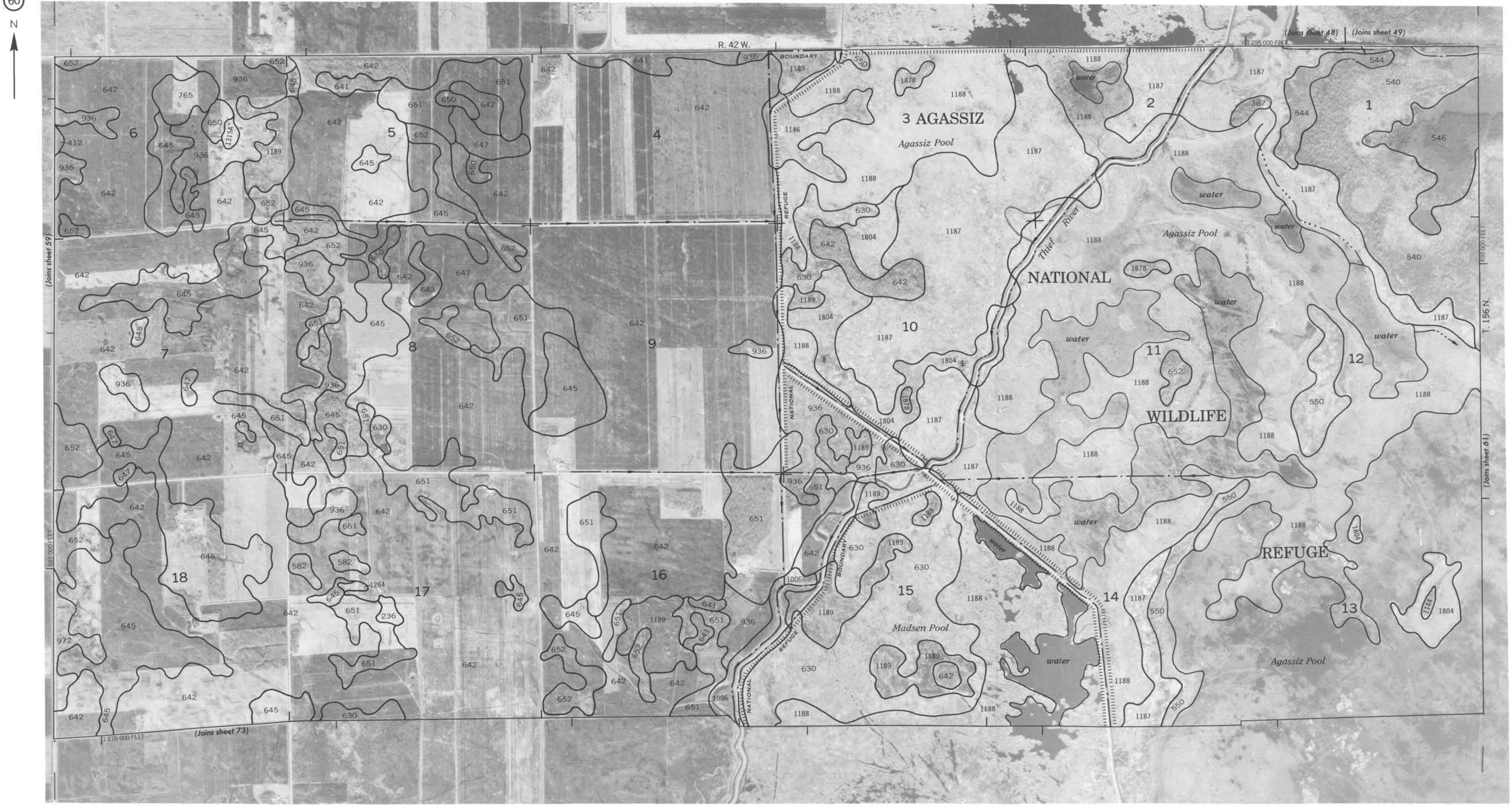
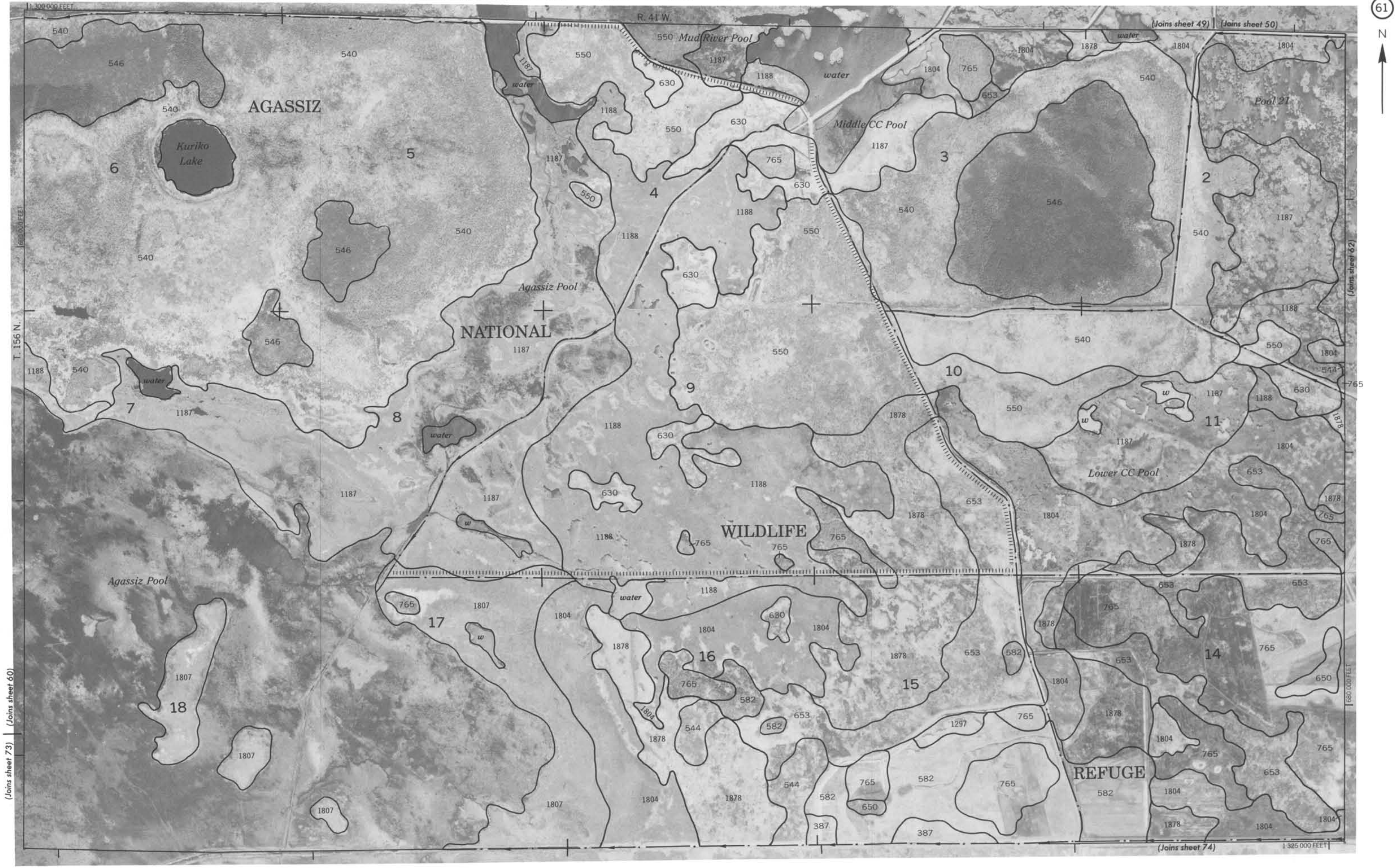
11
12
13
14
15
16
17
18

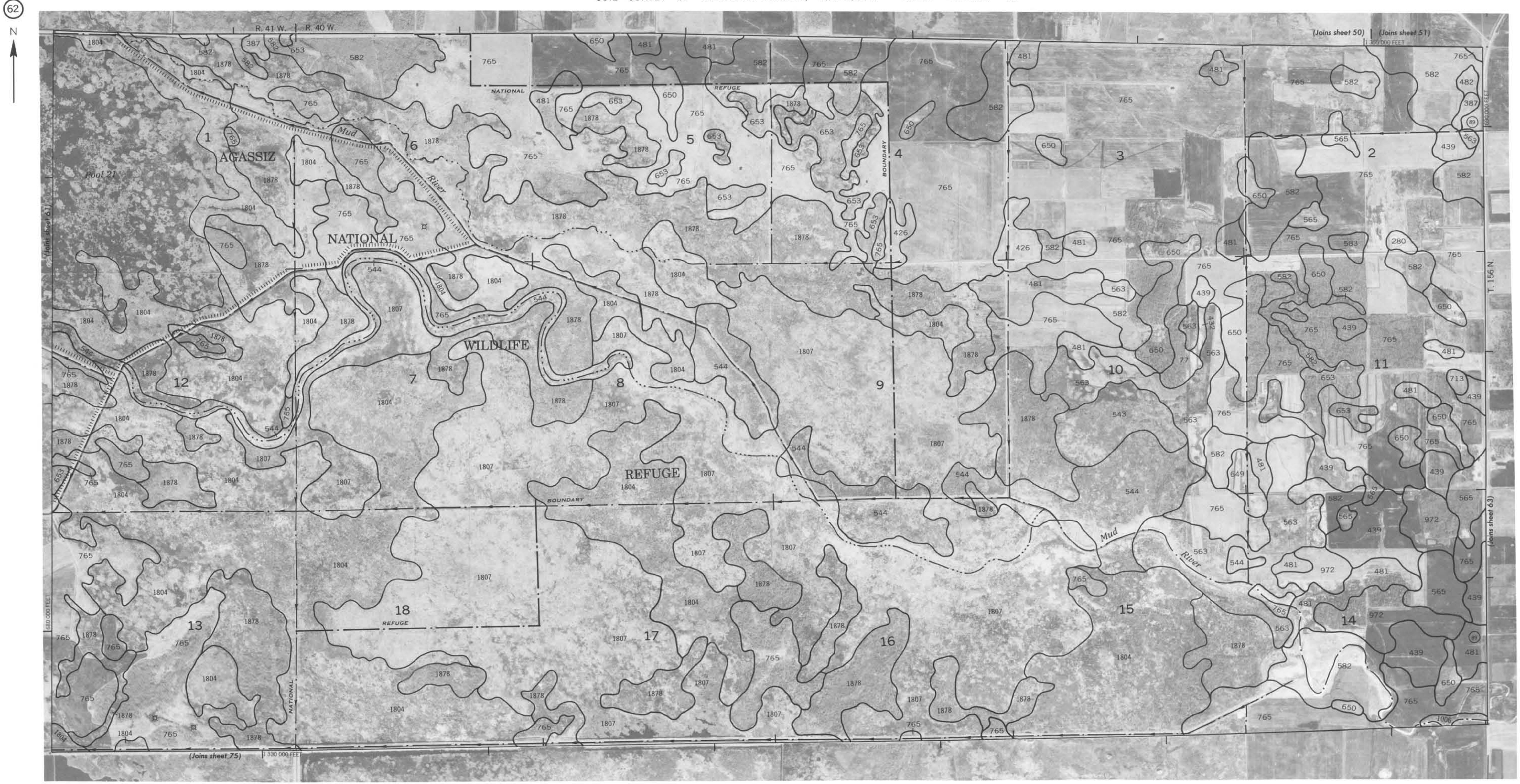
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 58


58
N
(Joins sheet 46)
(Joins sheet 47)
1 236 000 FEET
R. 44 W.
T. 156 N.
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 71)
1 205 000 FEET
585 000 FEET
605 000 FEET
NEW FOLDEN
Middle River
SEWAGE LAGOON
SOO LINE
59

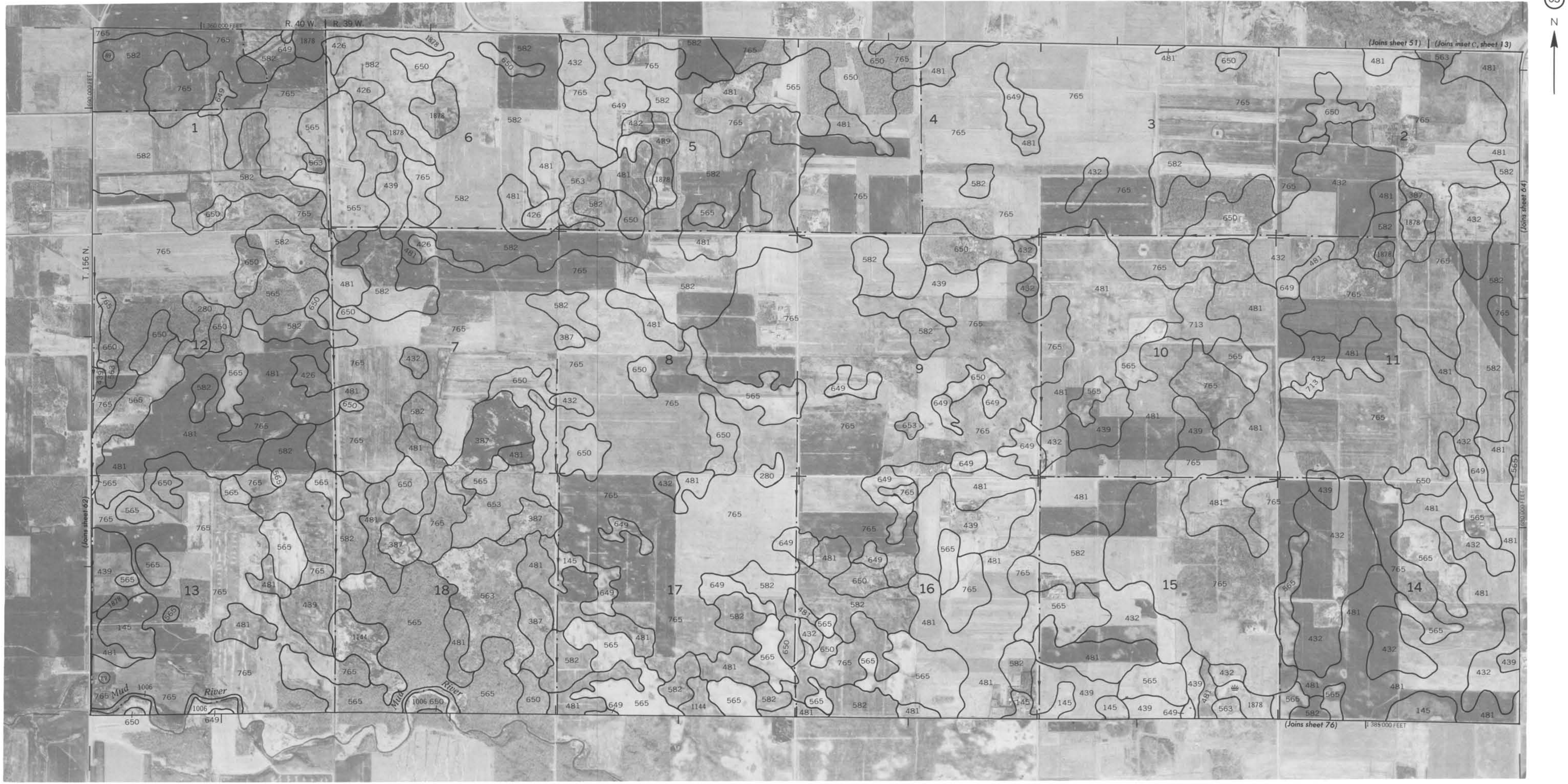

N
(Joins sheet 47)
(Joins sheet 48)
(Joins sheet 50)
(Joins sheet 58)
(Joins sheet 72)
R. 43 W.
T. 156 N.
1 240 000 FEET
1 265 000 FEET
695 000 FEET
BURLINGTON
NORTHERN
32
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18


N
R. 42 W.
T. 156 N.
(Joins sheet 48)
(Joins sheet 49)
(Joins sheet 59)
(Joins sheet 61)
(Joins sheet 73)
1 295 000 FEET
1 270 000 FEET
690 000 FEET
665 000 FEET
AGASSIZ
NATIONAL
WILDLIFE
REFUGE
Agassiz Pool
Madsen Pool
Thief River
NATIONAL REFUGE BOUNDARY
water
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
540
544
546
550
387
630
641
642
645
647
650
651
652
765
936
1006
1144
1146
1187
1188
1189
1264
1315A
1804
1878
412
972
582
236

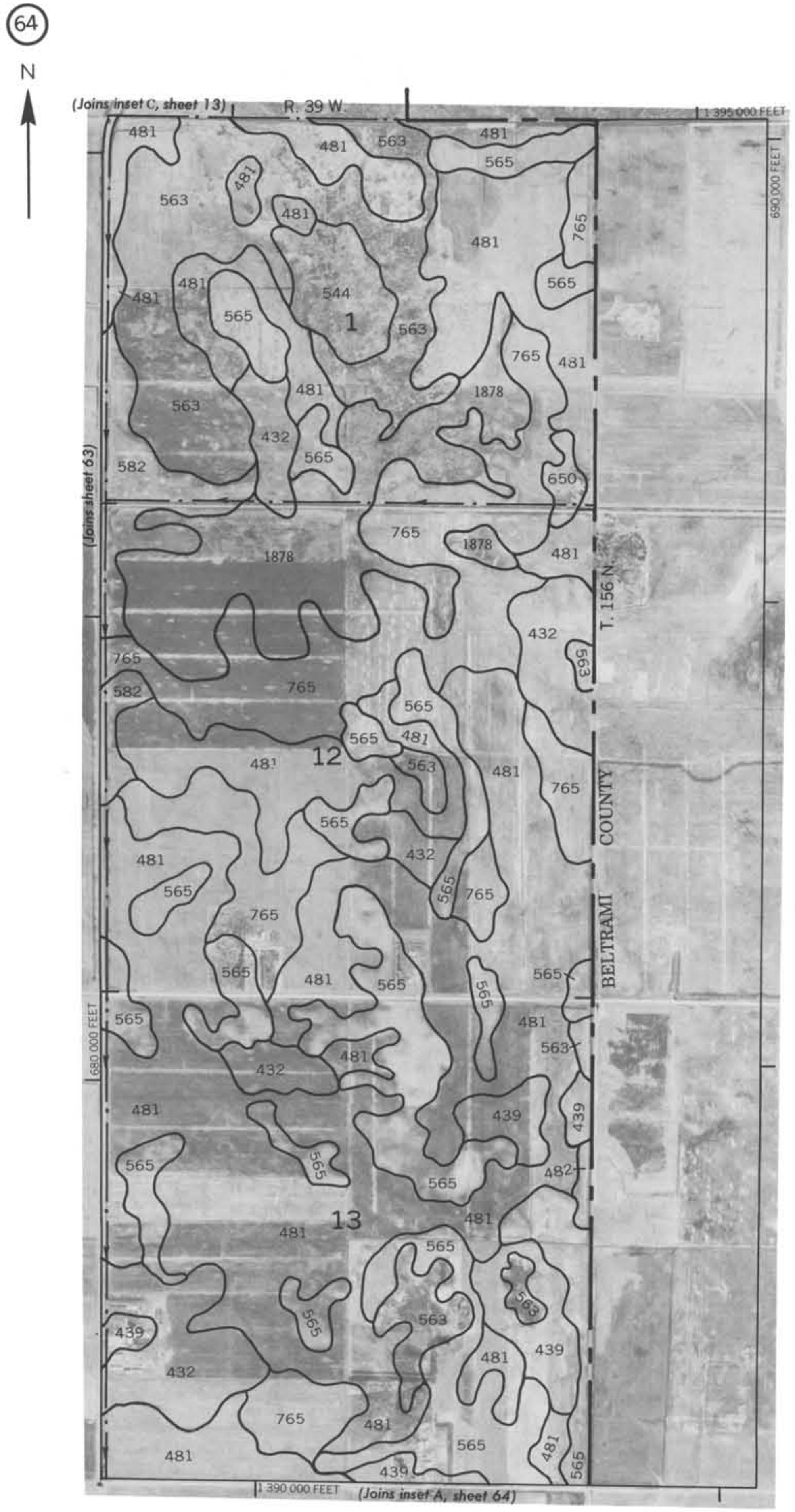

61
N
1 300 000 FEET
R. 41 W.
(Joins sheet 49)
(Joins sheet 50)
(Joins sheet 62)
(Joins sheet 74)
(Joins sheet 73)
(Joins sheet 60)
T. 156 N.
680 000 FEET
1 325 000 FEET
AGASSIZ
NATIONAL
WILDLIFE
REFUGE
Kuriko Lake
Mud River Pool
Middle CC Pool
Pool 21
Agassiz Pool
Lower CC Pool
water
w
1
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18
540
546
550
630
765
653
1187
1188
1804
1878
544
582
650
387
1297
1807

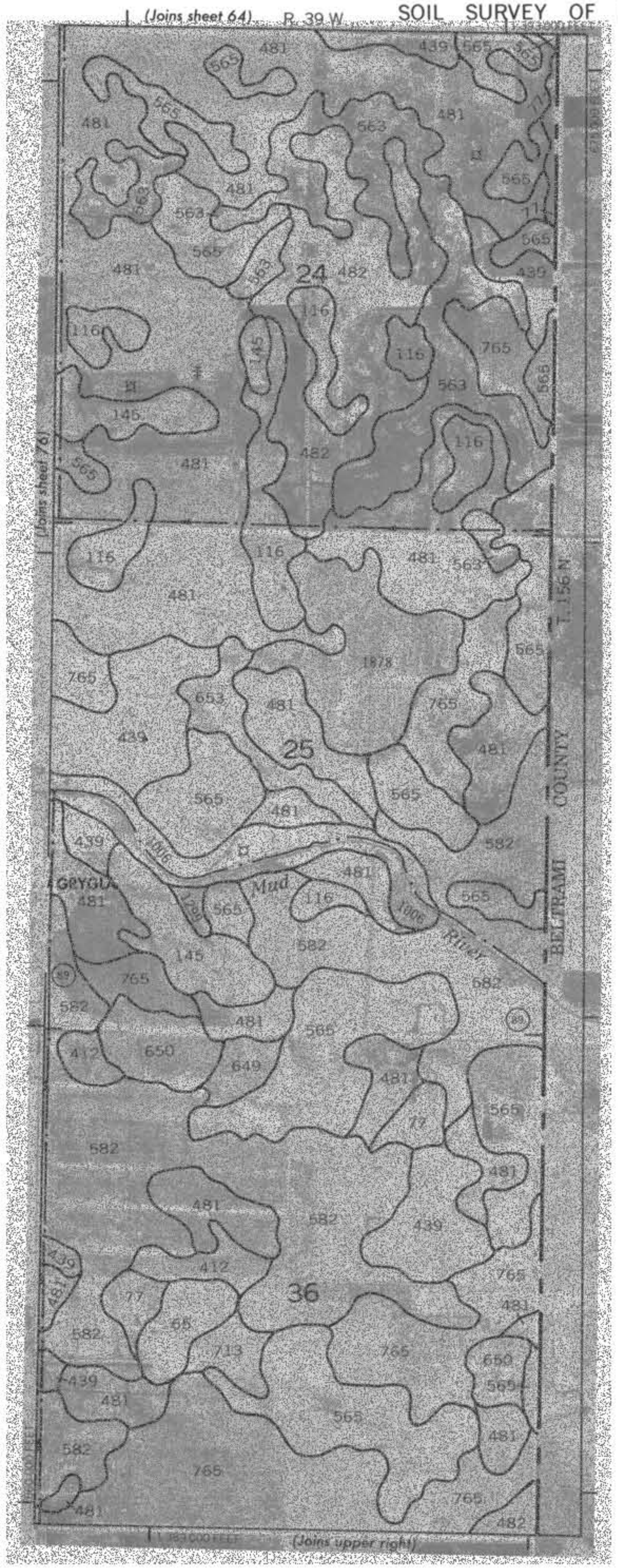

N
R. 41 W.
R. 40 W.
(Joins sheet 50)
(Joins sheet 51)
1 350 000 FEET
690 000 FEET
T. 156 N.
(Joins sheet 63)
(Joins sheet 75)
1 330 000 FEET
680 000 FEET
(Joins sheet 61)
AGASSIZ
NATIONAL
WILDLIFE
REFUGE
NATIONAL
REFUGE
BOUNDARY
Pool 21
Mud
River
Mud
River
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
89

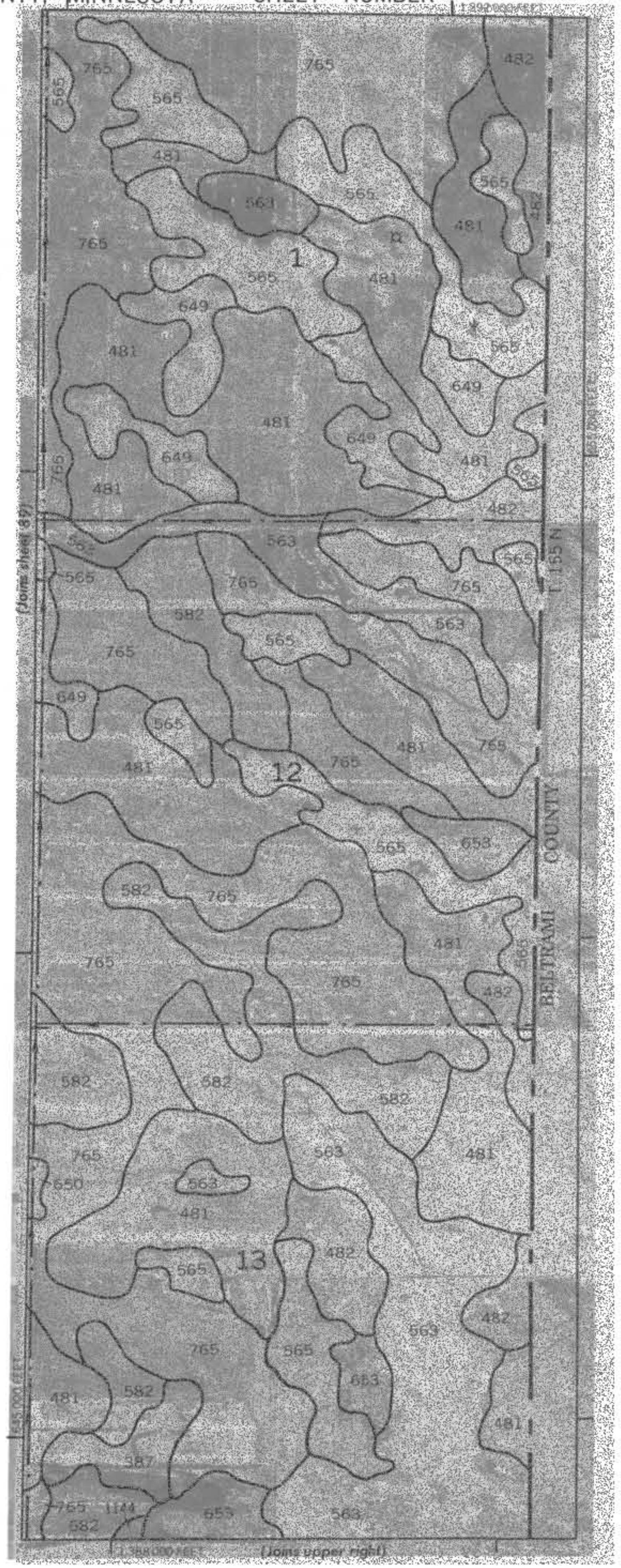
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 63

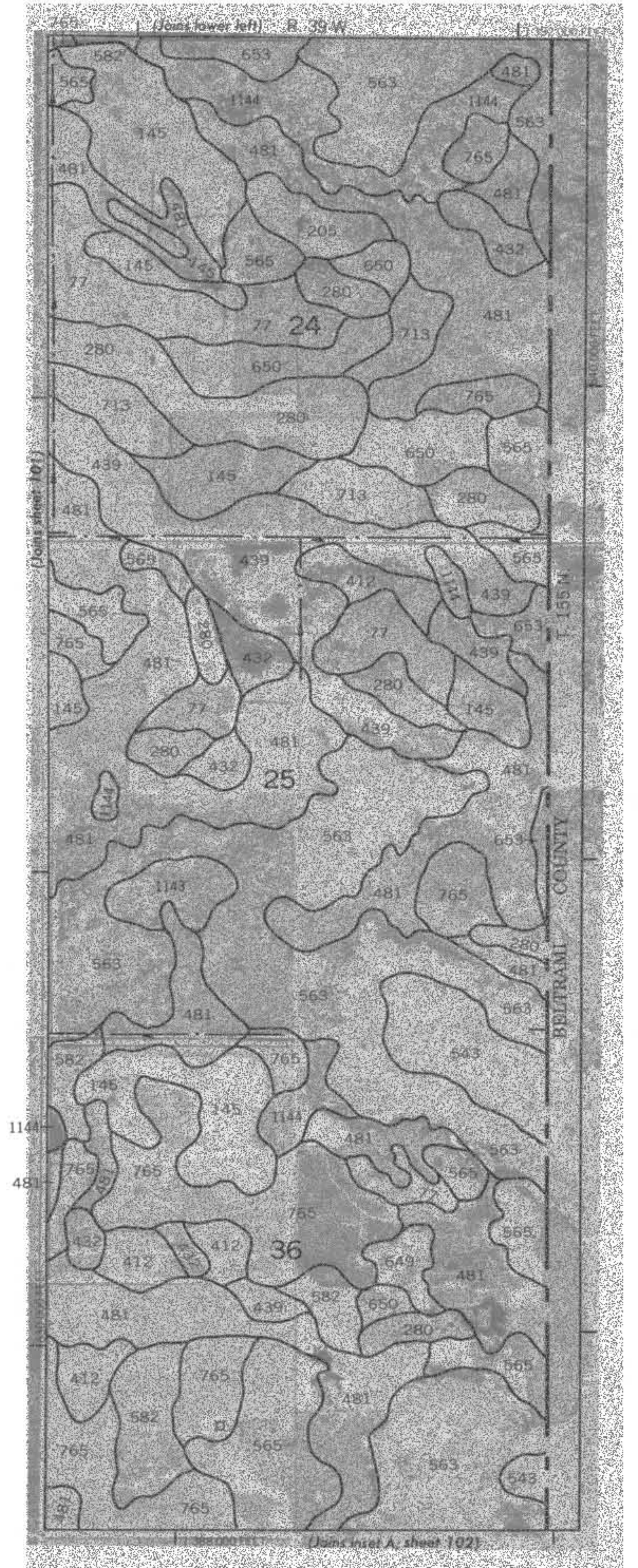

N
R. 40 W.
R. 39 W.
T. 156 N.
1 360 000 FEET
1 385 000 FEET
690 000 FEET
(Joins sheet 51)
(Joins inset C, sheet 13)
(Joins sheet 64)
(Joins sheet 76)
(Joins sheet 62)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Mud River
Mud River

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 64

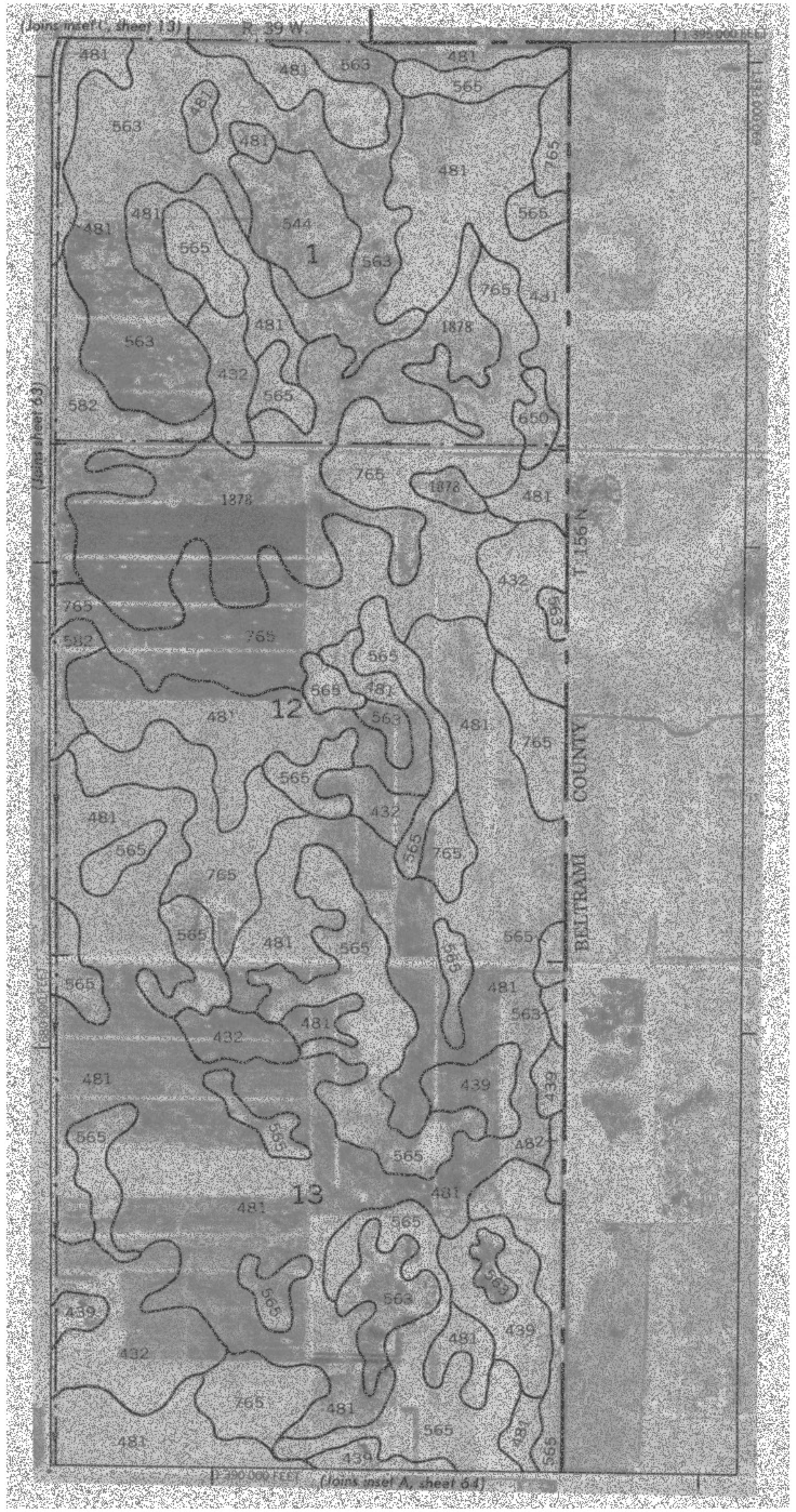

64
N
(Joins inset C, sheet 13)
R. 39 W.
1 395 000 FEET
690 000 FEET
(Joins sheet 63)
680 000 FEET
T. 156 N.
BELTRAMI COUNTY
1
12
13
1 390 000 FEET
(Joins inset A, sheet 64)

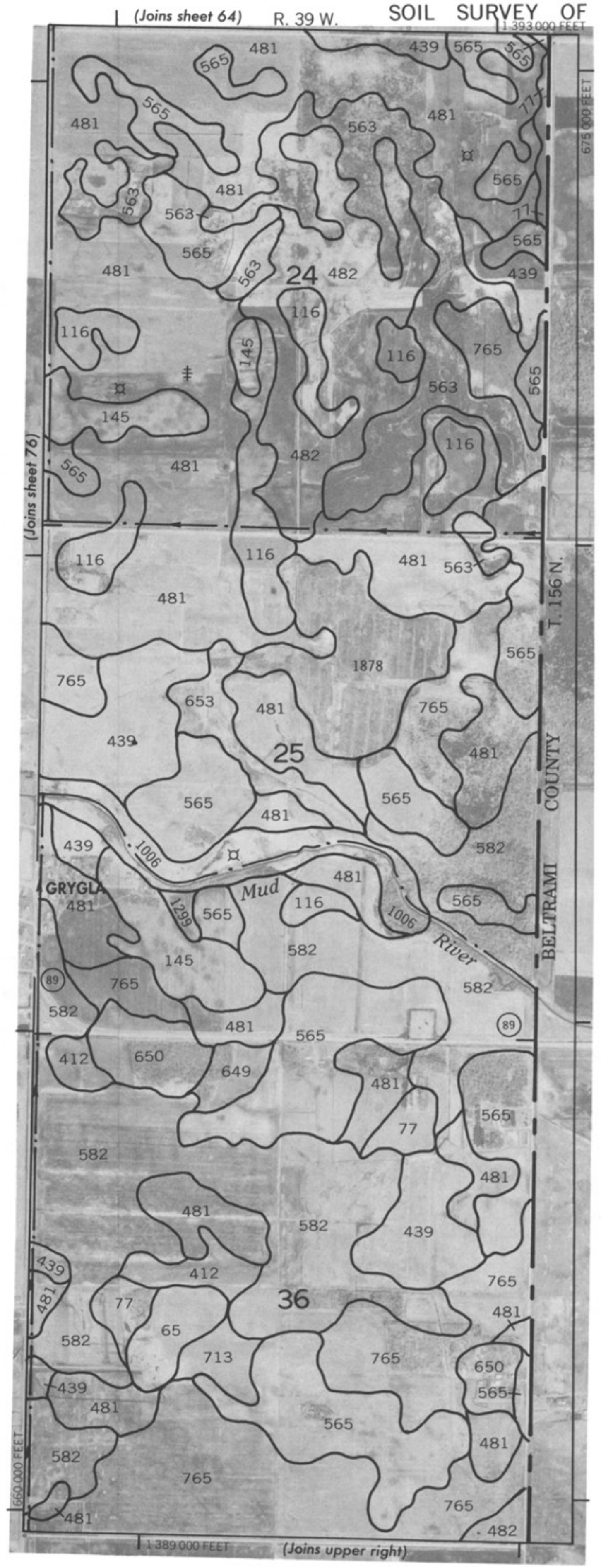

(Joins sheet 64)
R. 39 W.
(Joins sheet 76)
24
25
36
GRYGLA
Mud River
T. 156 N.
BELTRAMI COUNTY
(Joins upper right)

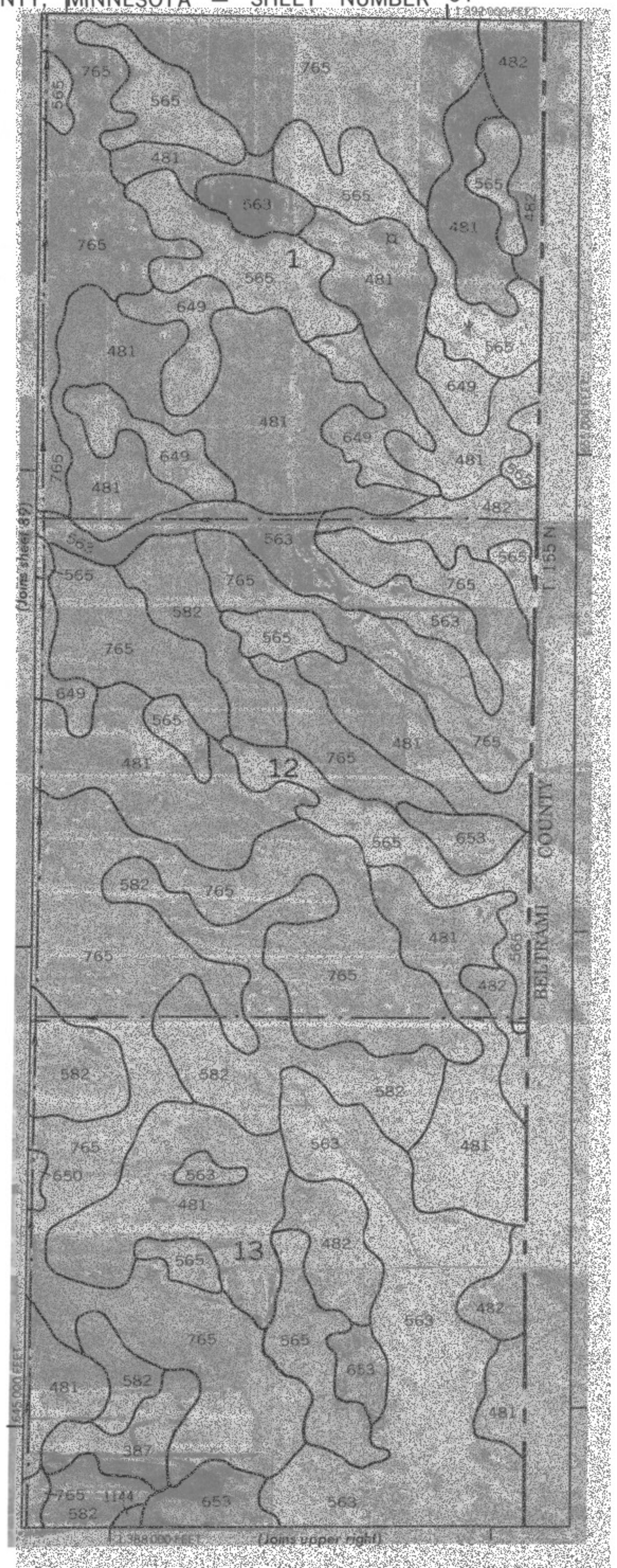

(Joins sheet 89)
1
12
13
T. 155 N.
BELTRAMI COUNTY
(Joins upper right)

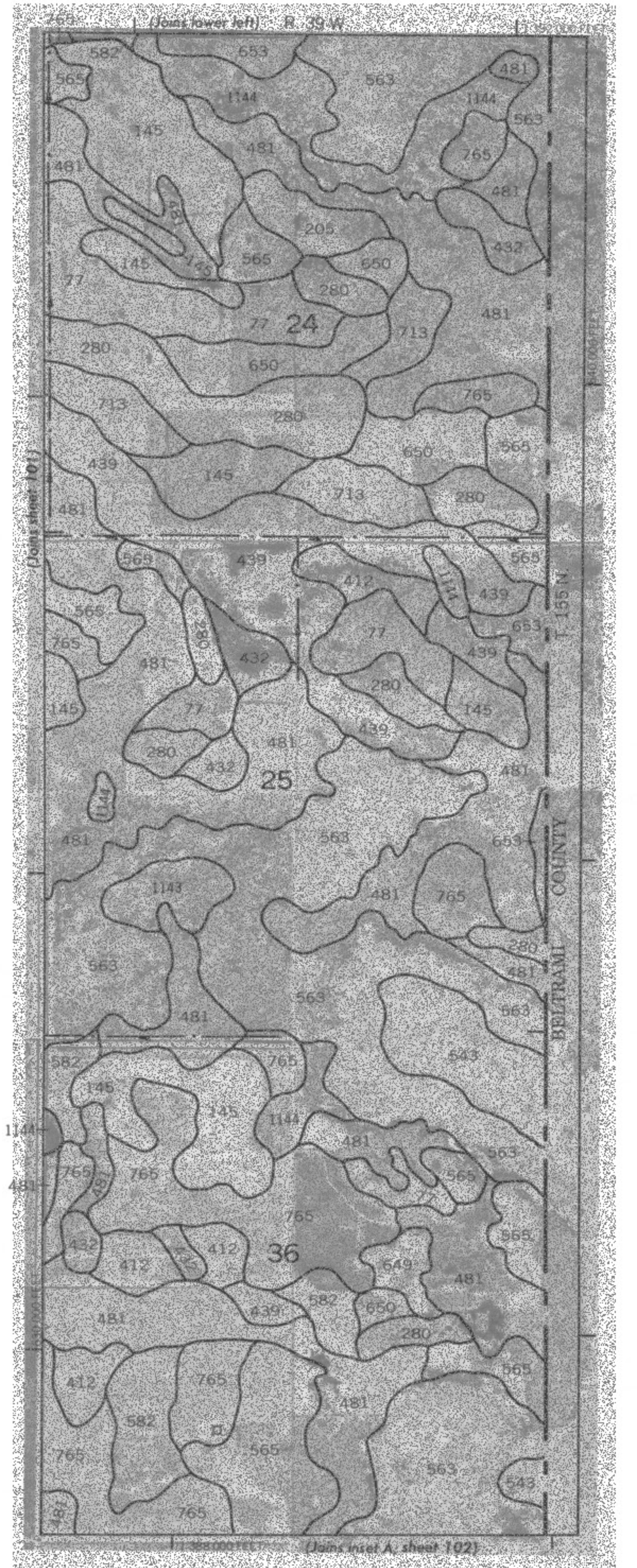

(Joins lower left)
R. 39 W.
(Joins sheet 101)
24
25
36
T. 155 N.
BELTRAMI COUNTY
(Joins inset A, sheet 102)

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 64

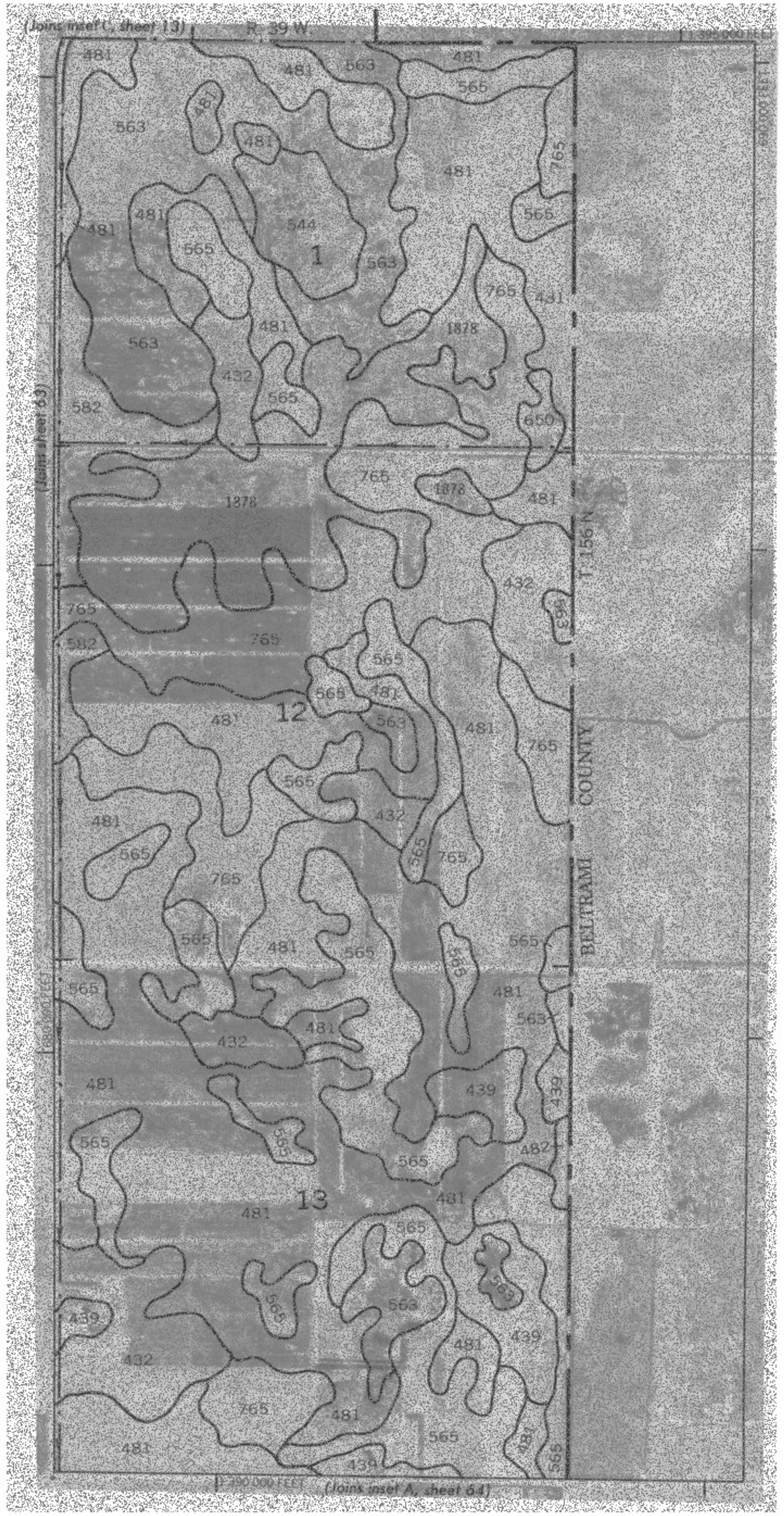

(Joins inset , sheet 13)
R. 39 W.
(Joins sheet 53)
T. 156 N.
BELTRAMI COUNTY
1
12
13
(Joins inset A, sheet 64)

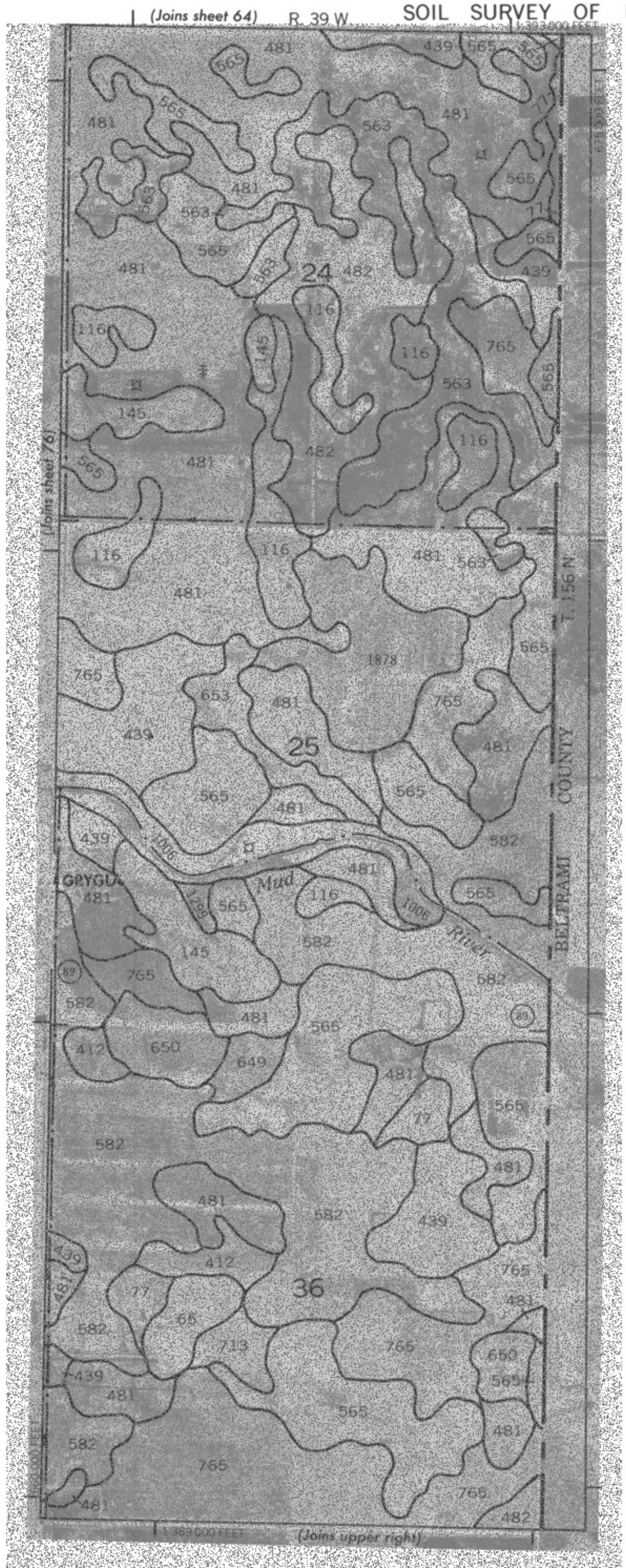

(Joins sheet 64)
R. 39 W.
1 393 000 FEET
(Joins sheet 76)
24
25
36
GRYGLA
Mud River
89
T. 156 N.
BELTRAMI COUNTY
1 389 000 FEET
(Joins upper right)

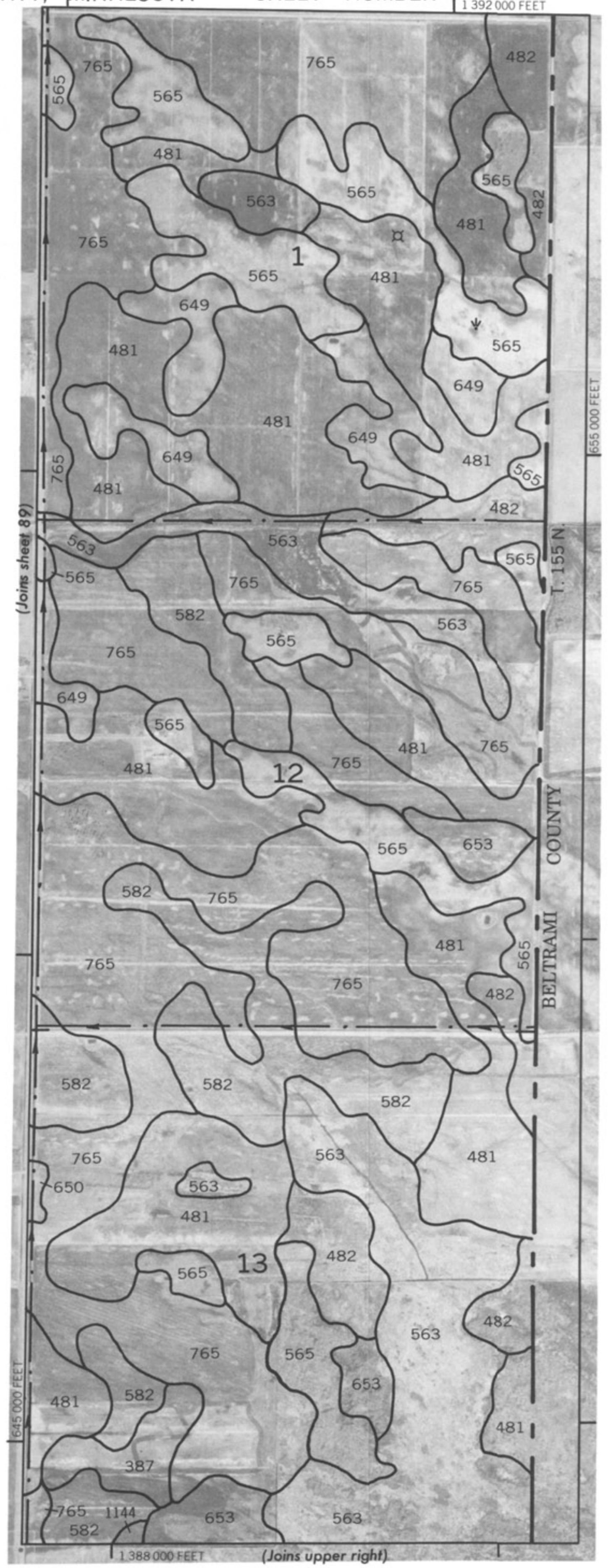

1 392 000 FEET
(Joins sheet 89)
1
12
13
T. 155 N.
BELTRAMI COUNTY
1 388 000 FEET
(Joins upper right)

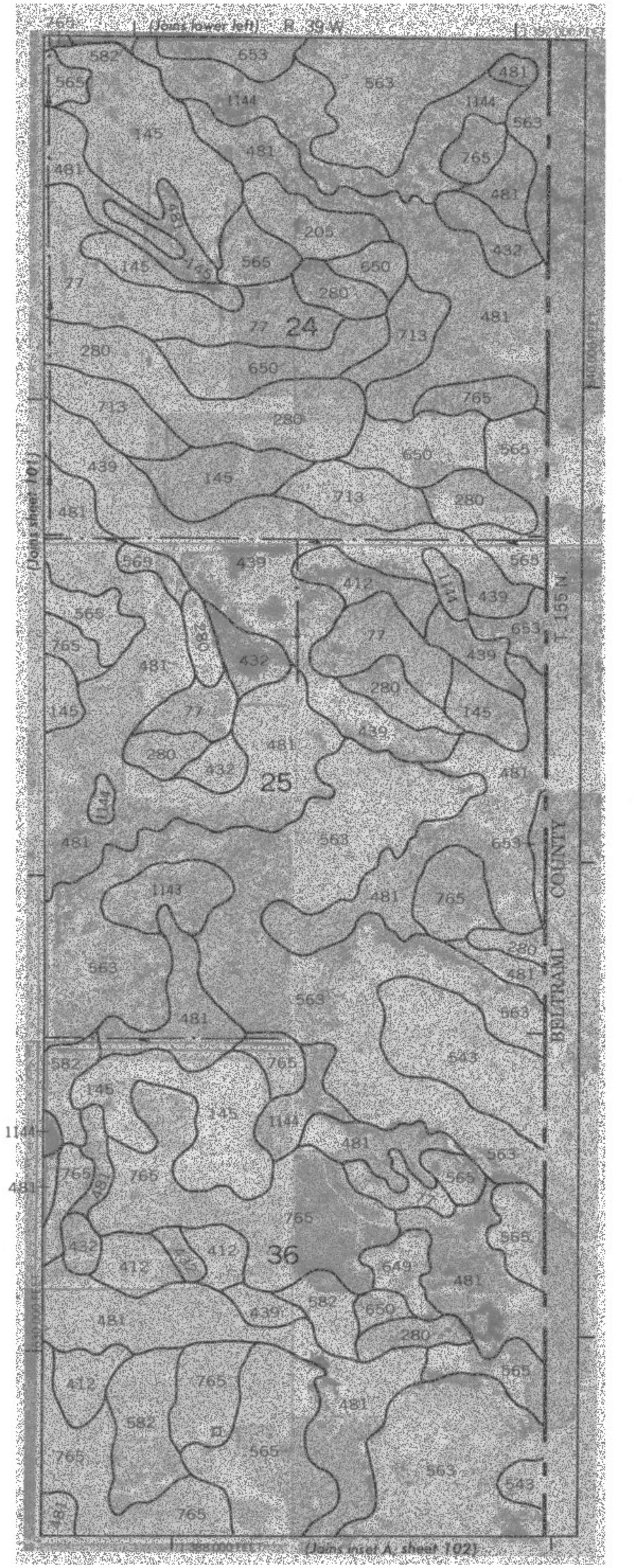

(Joins lower left)
R. 39 W.
(Joins sheet 101)
24
25
36
T. 155 N.
BELTRAMI COUNTY
(Joins inset A, sheet 102)

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 64

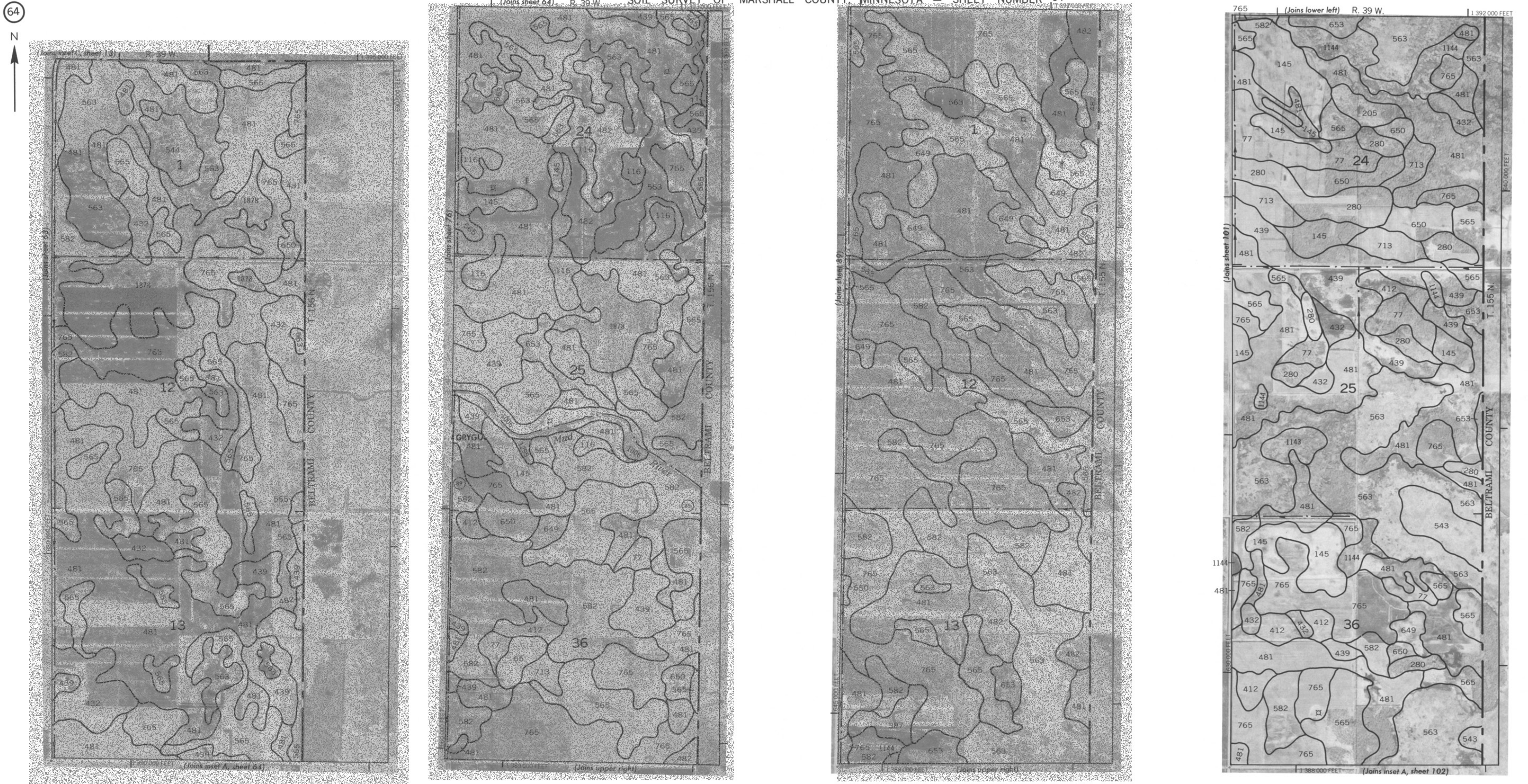

(Joins inset 1, sheet 13)
R. 39 W.
(Joins sheet 63)
T. 156 N.
BELTRAMI COUNTY
1
12
13
(Joins inset A, sheet 64)


(Joins sheet 64)
R. 39 W.
(Joins sheet 76)
T. 156 N.
BELTRAMI COUNTY
24
25
36
Mud River
GRYGLA
(Joins upper right)


1 392 000 FEET
(Joins sheet 89)
T. 155 N.
BELTRAMI COUNTY
1
12
13
1 388 000 FEET
(Joins upper right)

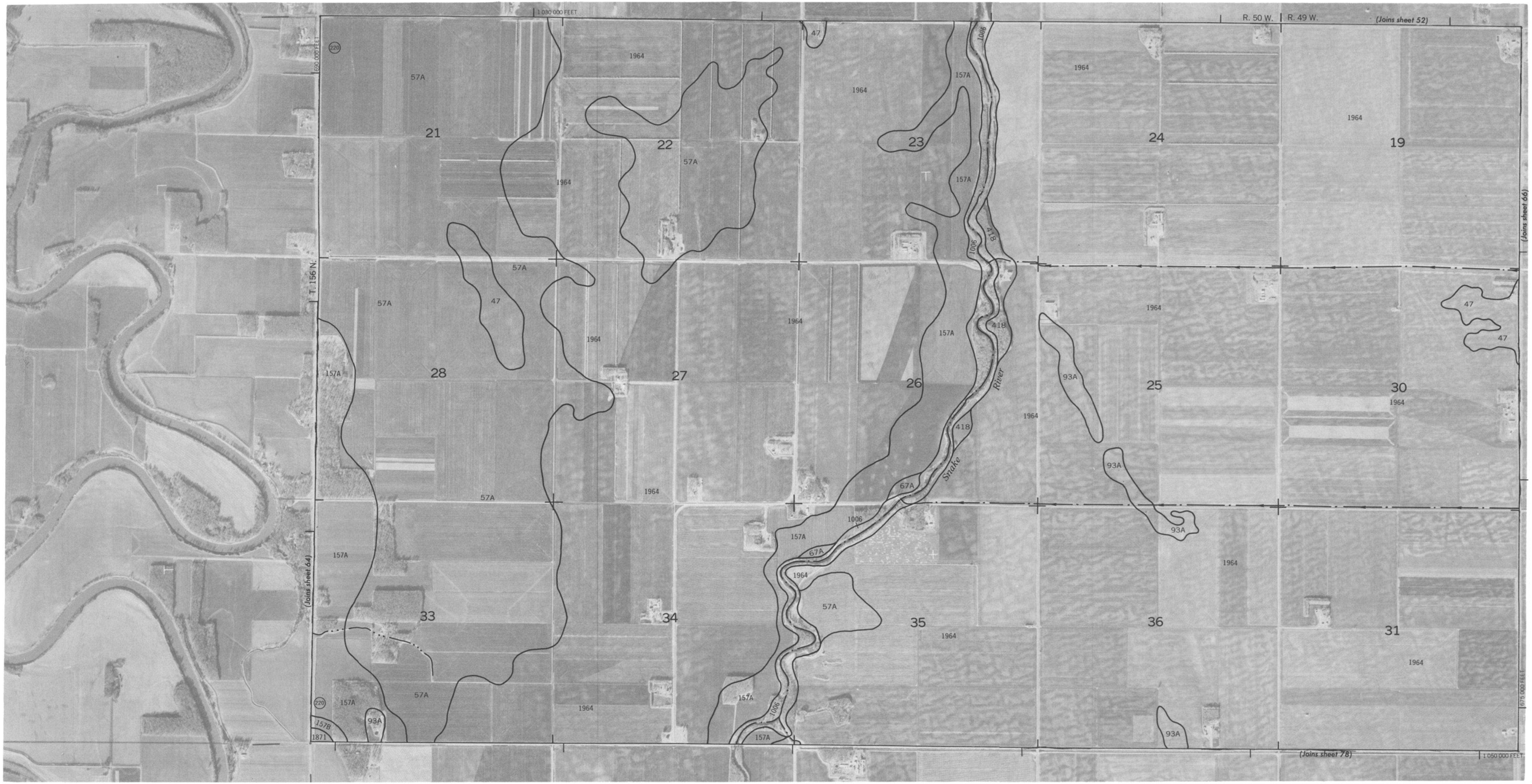

(Joins lower left)
R. 39 W.
(Joins sheet 101)
T. 155 N.
BELTRAMI COUNTY
24
25
36
(Joins inset A, sheet 102)

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 64


64
N
(Joins inset 1, sheet 13)
R. 39 W.
(Joins sheet 63)
T. 156 N.
BELTRAMI COUNTY
1
12
13
(Joins inset A, sheet 64)
(Joins sheet 64)
(Joins sheet 76)
24
25
36
GRYGLA
Mud River
(Joins upper right)
(Joins sheet 89)
T. 155 N.
(Joins lower left)
(Joins sheet 101)
(Joins inset A, sheet 102)
1 392 000 FEET
1 388 000 FEET

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 65

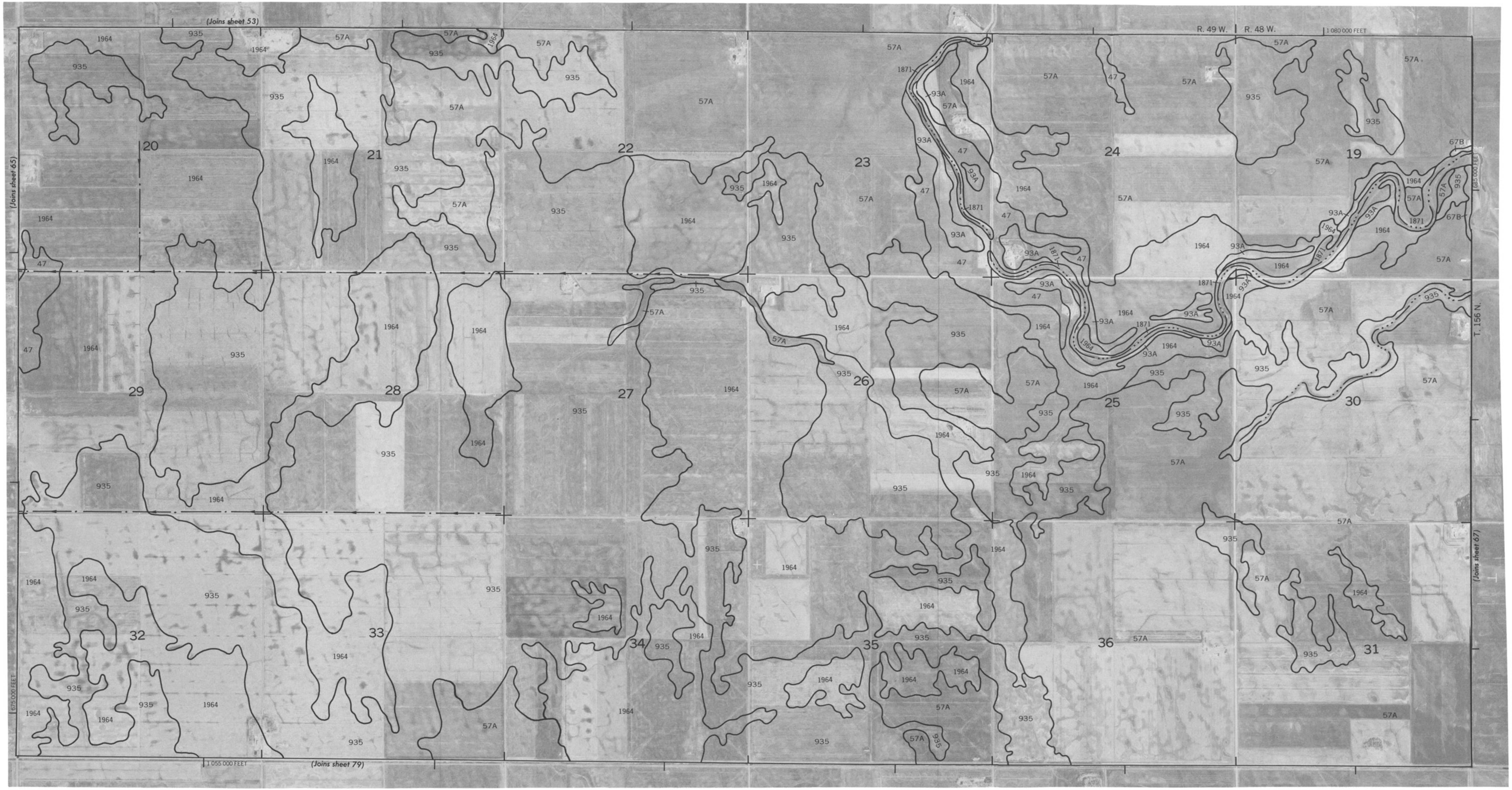
N


1 030 000 FEET
R. 50 W.
R. 49 W.
(Joins sheet 52)
650 000 FEET
220
47
1006
1964
57A
157A
21
22
57A
1964
23
24
1964
19
1964
157A
418
1006
T. 156 N.
57A
57A
47
1964
1964
157A
418
47
47
(Joins sheet 66)
157A
28
27
26
93A
25
30
1964
River
418
1964
1964
93A
Snake
67A
57A
1964
1006
157A
67A
93A
157A
1964
1964
(Joins sheet 64)
57A
33
34
35
36
31
1964
1964
220
157A
57A
157A
1006
1964
157B
93A
1871
157A
93A
675 000 FEET
(Joins sheet 78)
1 050 000 FEET

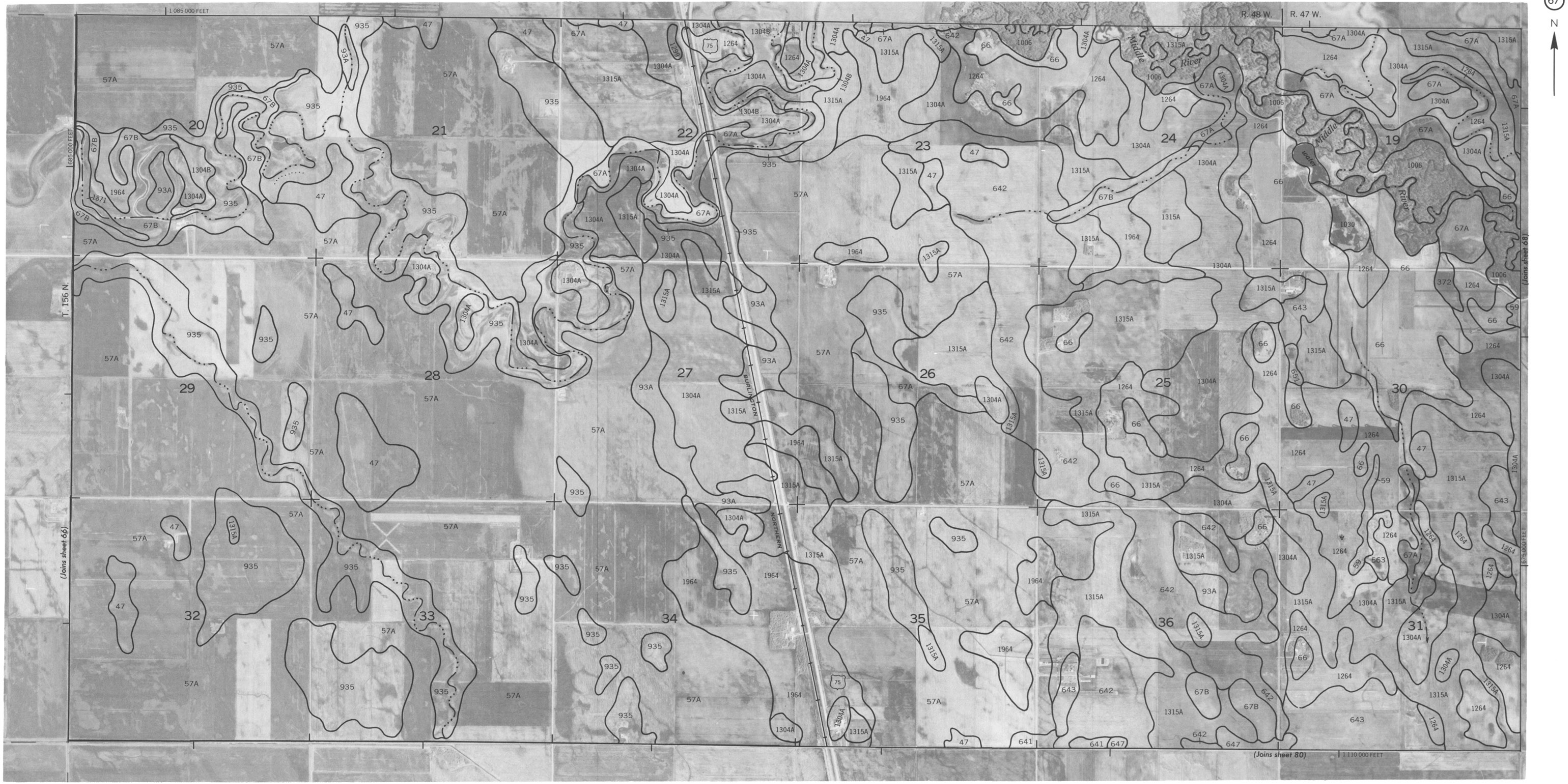
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 66

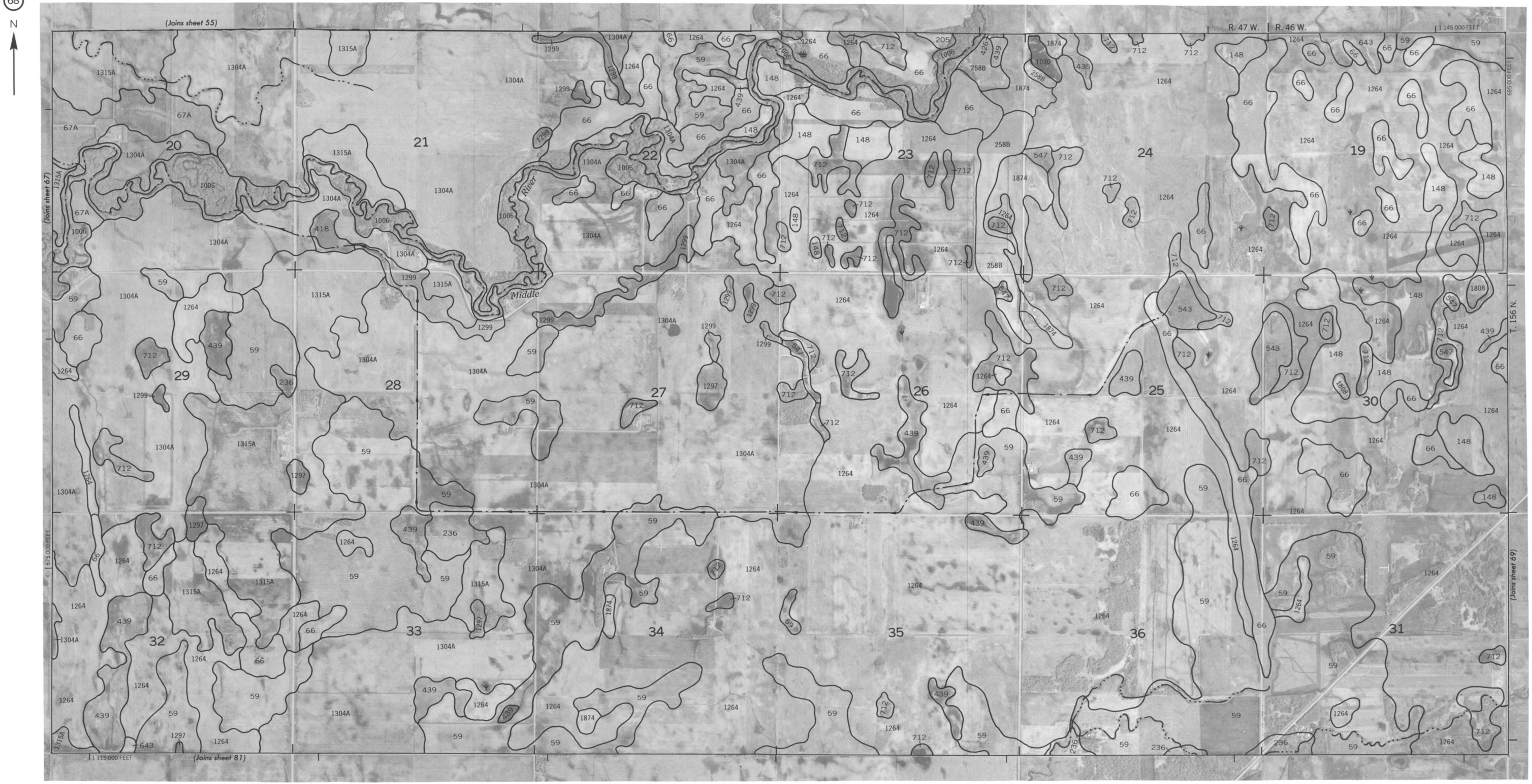
⑥⑥

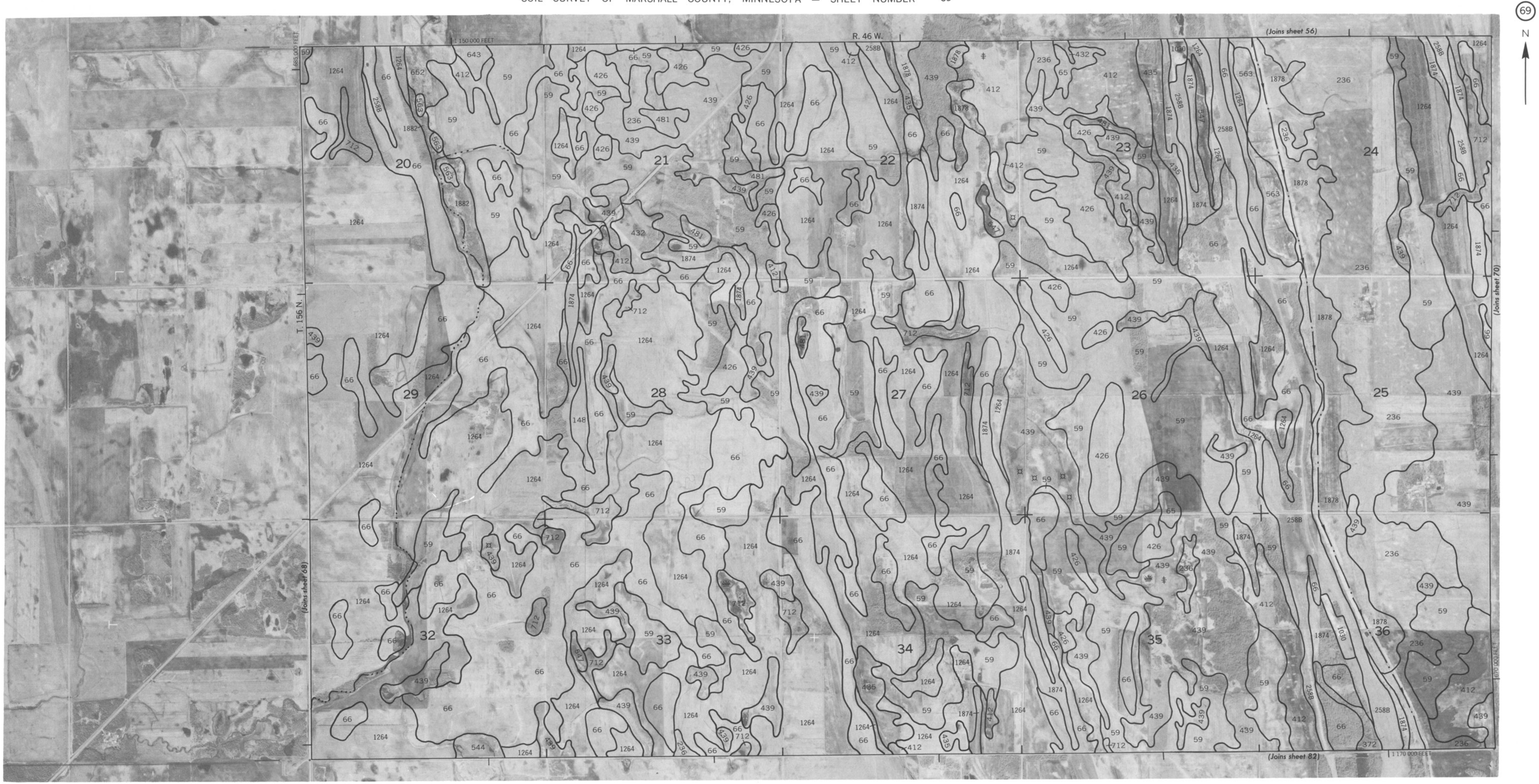
N


(Joins sheet 53)
(Joins sheet 65)
(Joins sheet 67)
(Joins sheet 79)
R. 49 W.
R. 48 W.
T. 156 N.
1 080 000 FEET
685 000 FEET
1 055 000 FEET
675 000 FEET
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
47
57A
67B
93A
935
1871
1964

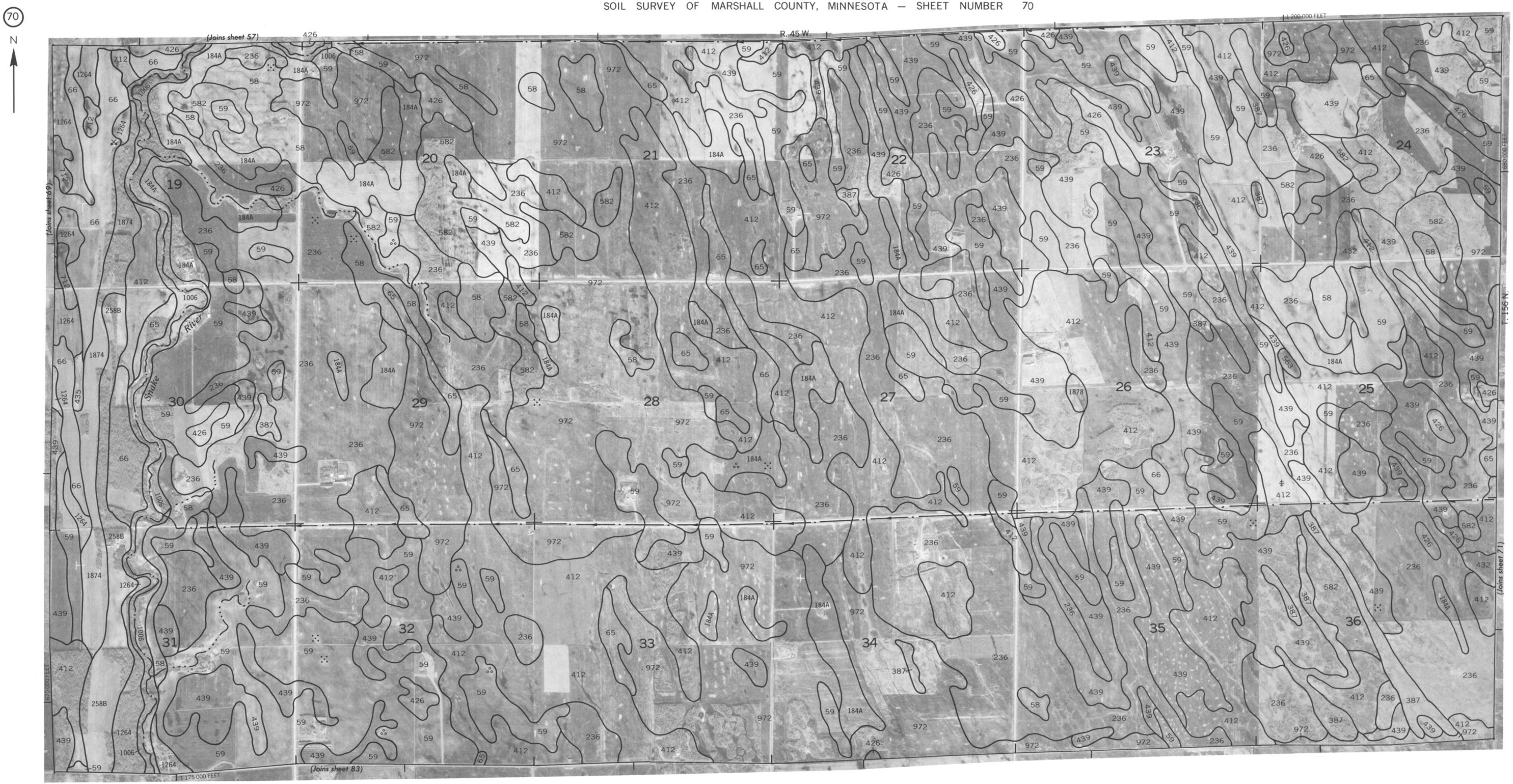
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 67

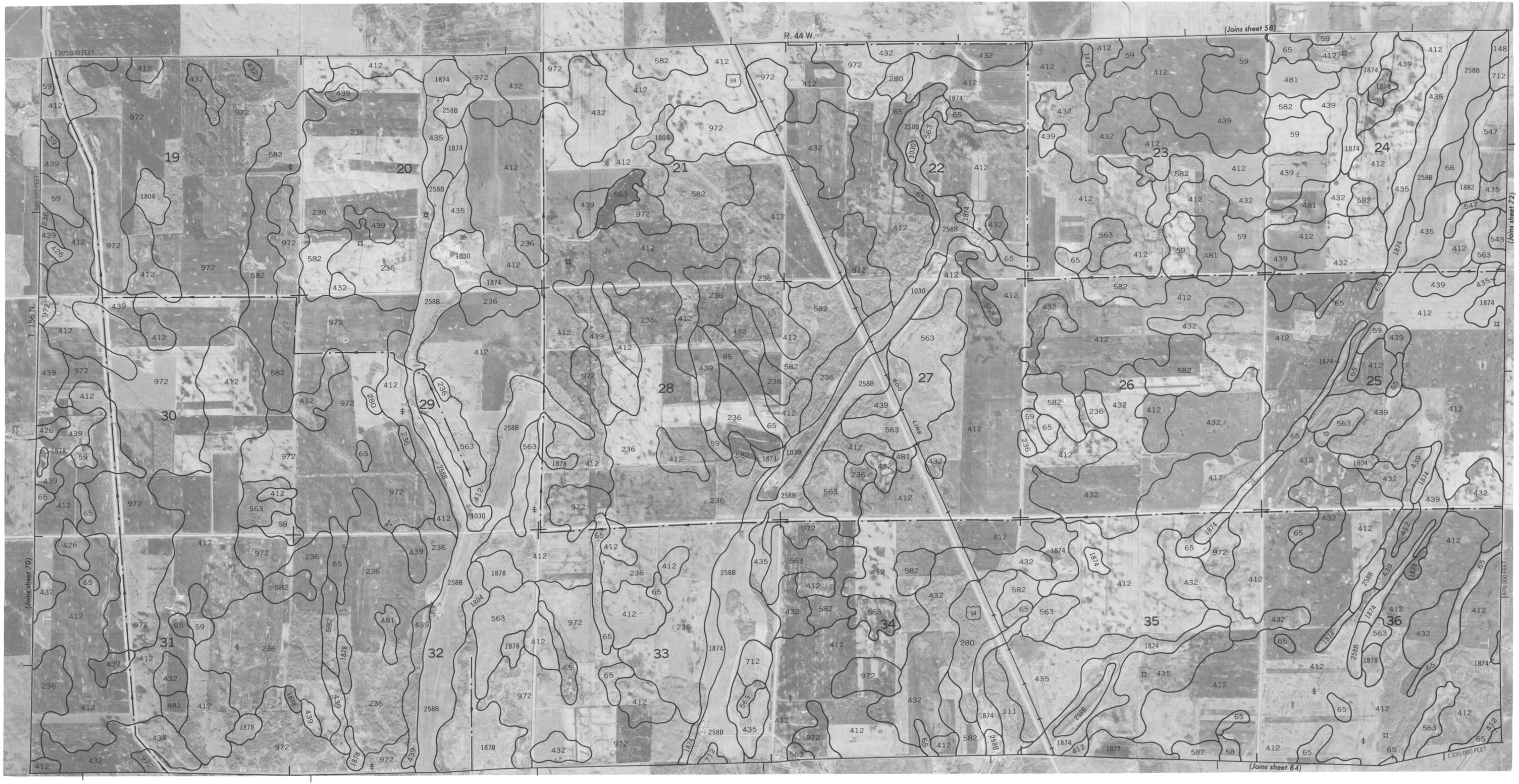

N
1 085 000 FEET
685 000 FEET
R. 48 W.
R. 47 W.
T. 156 N.
(Joins sheet 66)
(Joins sheet 68)
(Joins sheet 80)
1 110 000 FEET
675 000 FEET
Middle River
Middle River
water
BURLINGTON NORTHERN
75
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
57A
935
47
67A
67B
93A
1304A
1304B
1315A
1264
1964
1871
642
66
1006
1030
1315A
372
643
59
663
641
647

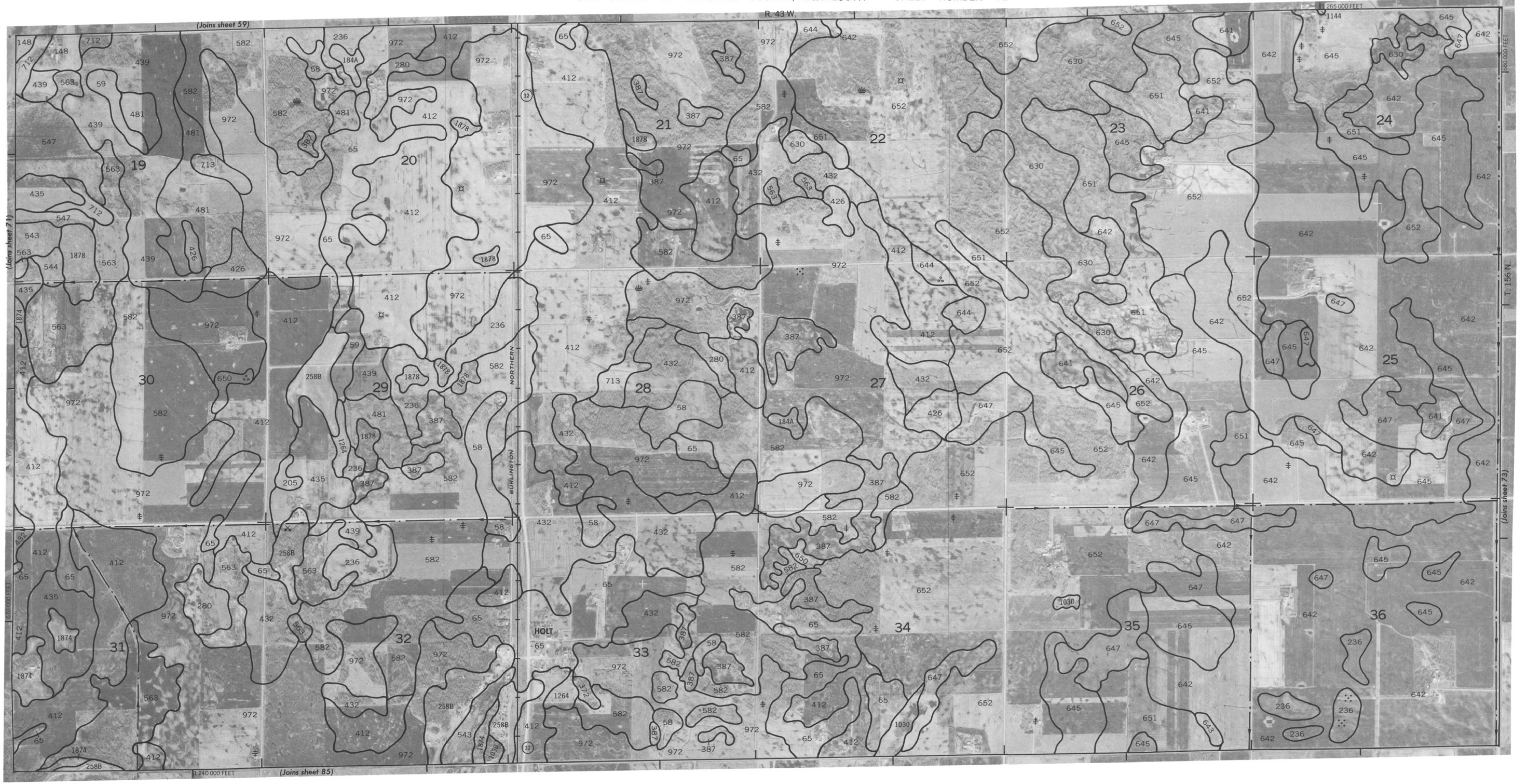

N
(Joins sheet 55)
(Joins sheet 67)
(Joins sheet 69)
(Joins sheet 81)
R. 47 W.
R. 46 W.
T. 156 N.
1 145 000 FEET
685 000 FEET
675 000 FEET
1 115 000 FEET
Middle
River
20
21
22
23
24
19
29
28
27
26
25
30
32
33
34
35
36
31
59
66
67A
148
205
236
258B
418
426
435
439
543
547
643
712
1006
1030
1264
1297
1299
1304A
1315A
1808
1874


69
N
R. 46 W.
T. 156 N.
(Joins sheet 56)
(Joins sheet 70)
(Joins sheet 82)
(Joins sheet 68)
1 150 000 FEET
1 170 000 FEET
685 000 FEET
670 000 FEET
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 70

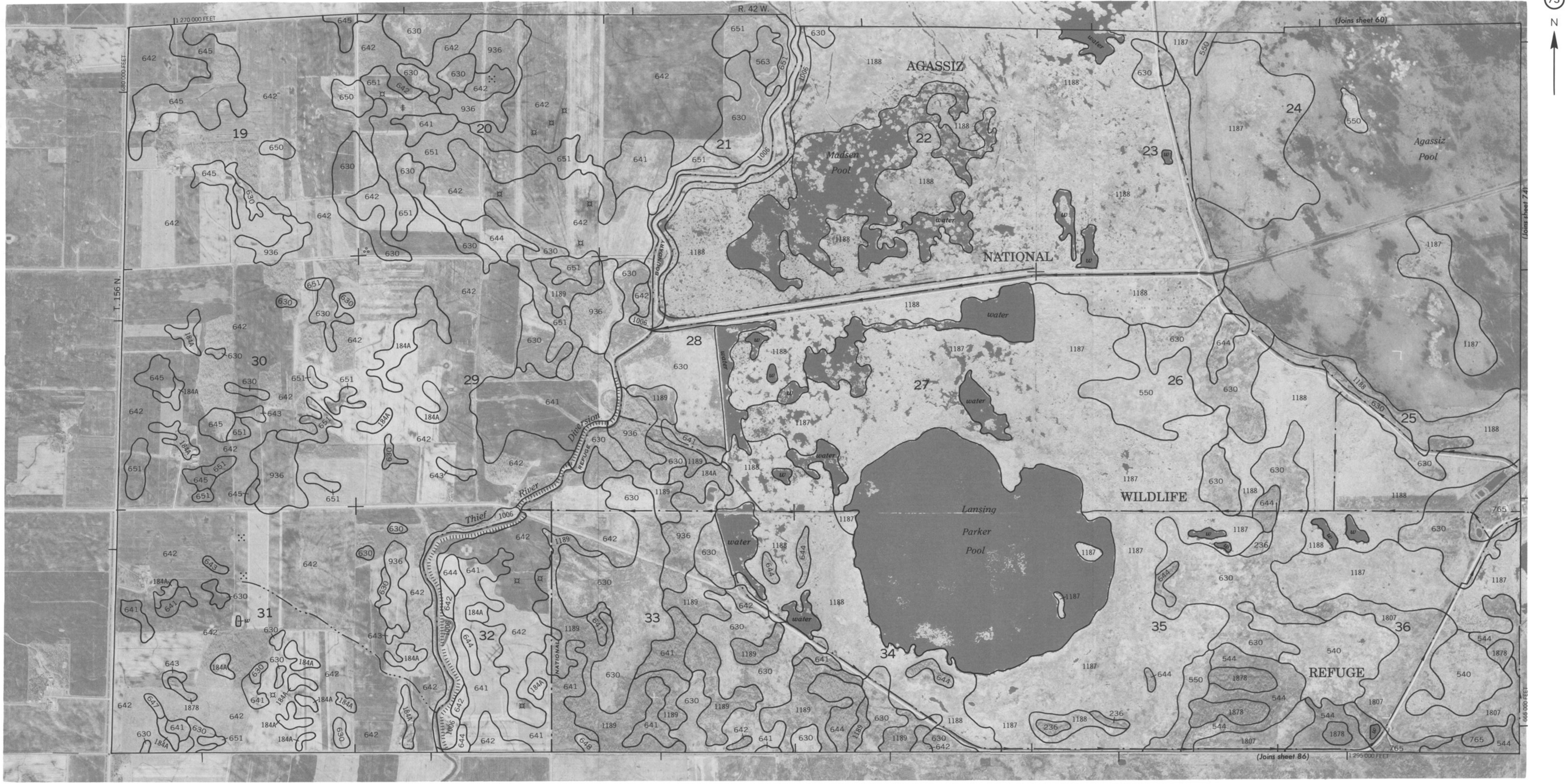

70
N
(Joins sheet 57)
R. 45 W.
1 200 000 FEET
(Joins sheet 69)
880 000 FEET
T. 156 N.
(Joins sheet 71)
670 000 FEET
1 175 000 FEET
(Joins sheet 83)
Snake River
19
20
21
22
23
24
30
29
28
27
26
25
31
32
33
34
35
36
1264
1874
258B
1006
712
66
65
58
59
184A
236
387
412
426
432
435
439
563
582
972
1878


N
(Joins sheet 58)
R. 44 W.
1 205 000 FEET
880 000 FEET
T. 156 N.
(Joins sheet 72)
(Joins sheet 70)
870 000 FEET
1 235 000 FEET
(Joins sheet 84)
500 LINE
59
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

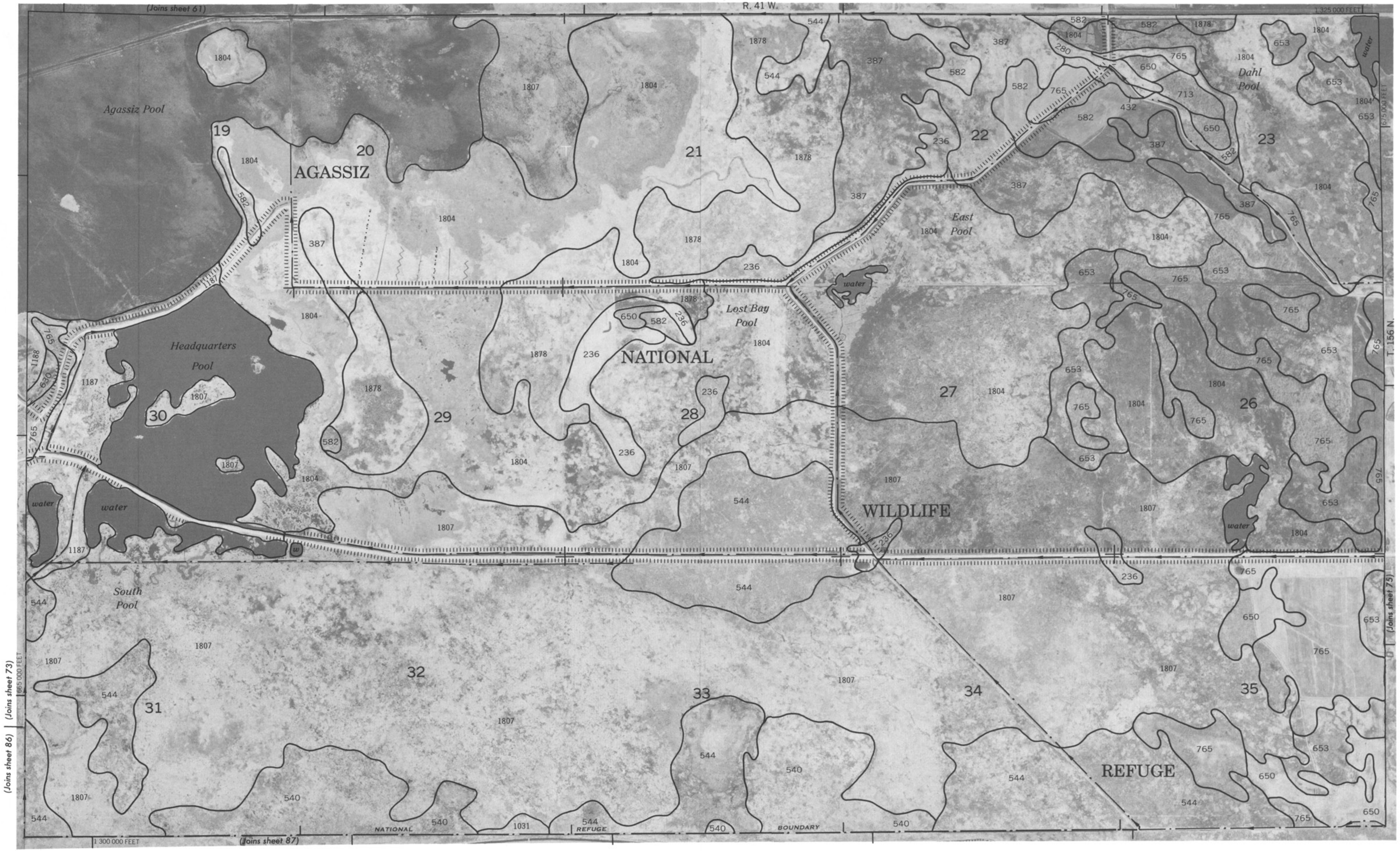

N
R. 43 W.
(Joins sheet 59)
(Joins sheet 71)
(Joins sheet 73)
(Joins sheet 85)
T. 156 N.
265 000 FEET
680 000 FEET
670 000 FEET
1 240 000 FEET
NORTHERN
BURLINGTON
HOLT
32
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

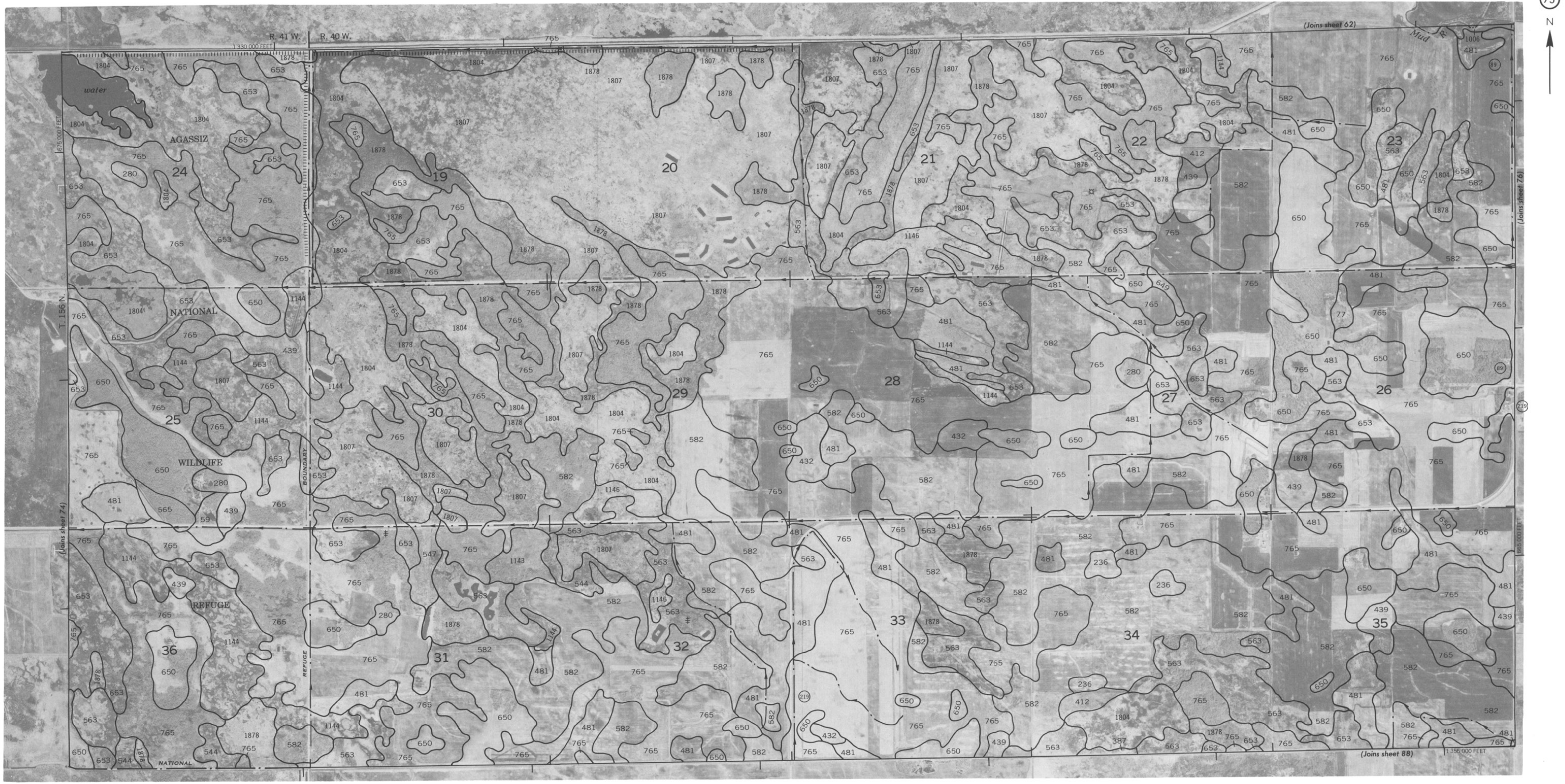
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 73

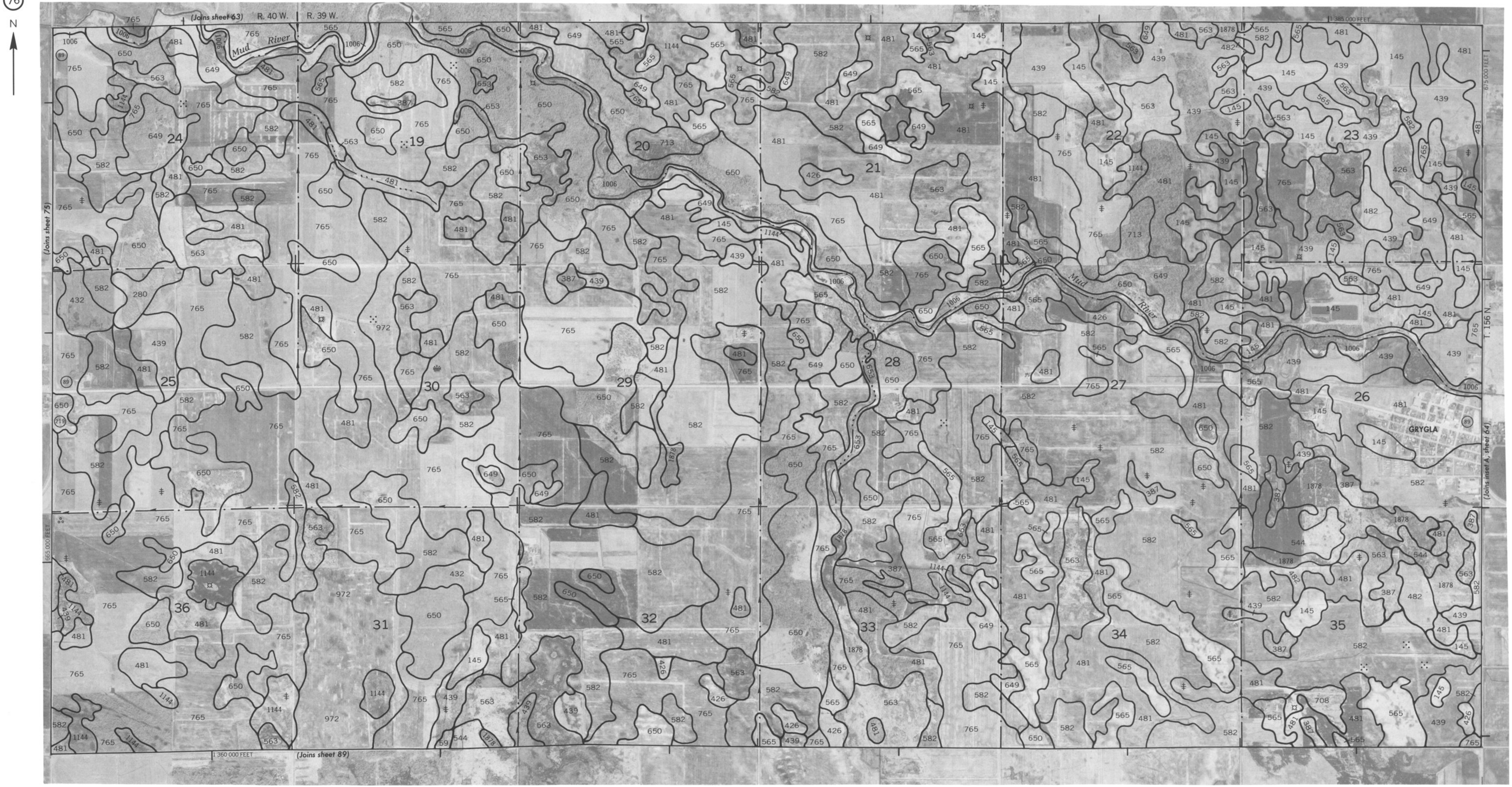
(73)

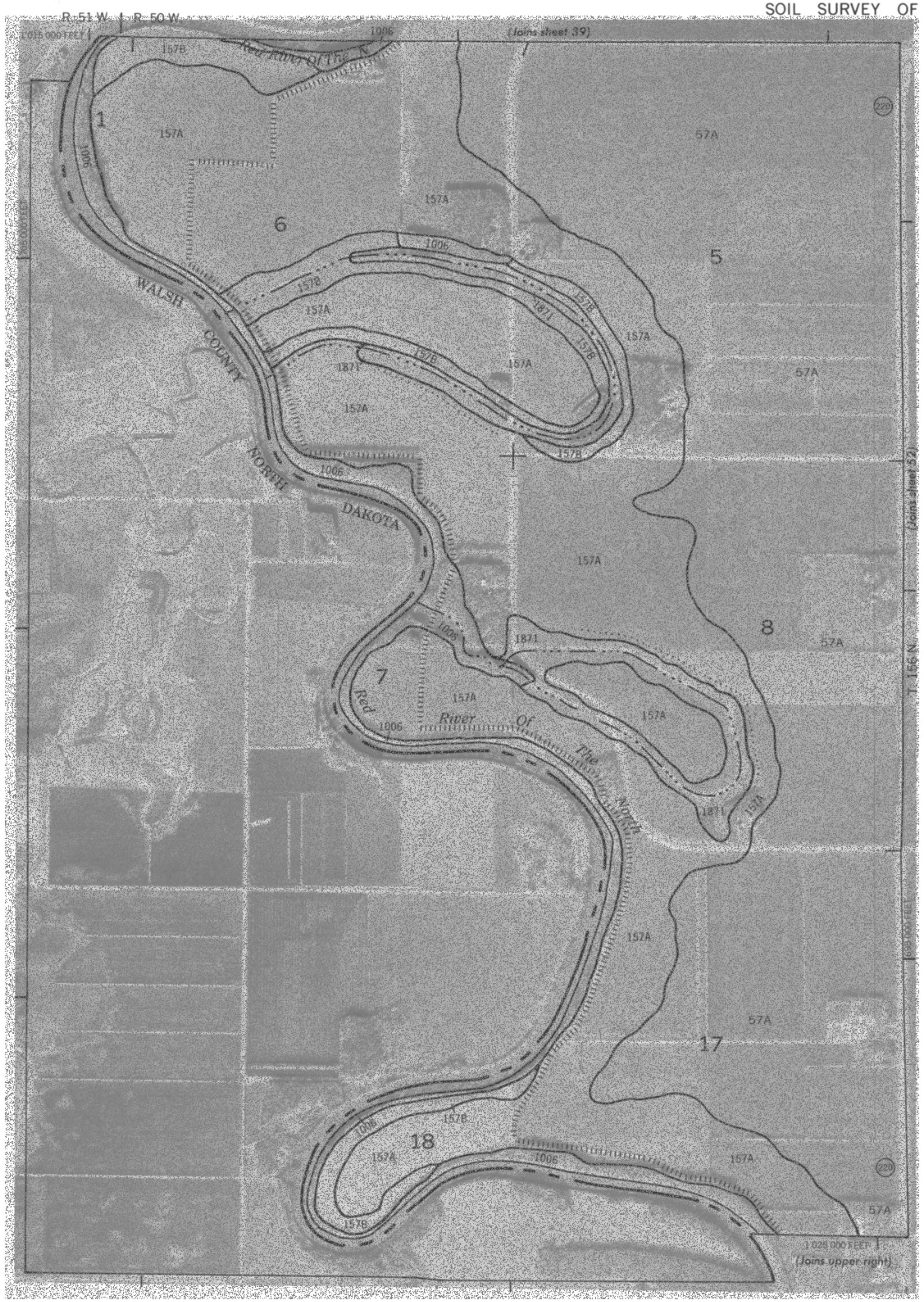

N
R. 42 W.
T. 156 N.
1 270 000 FEET
680 000 FEET
1 295 000 FEET
666 000 FEET
(Joins sheet 60)
(Joins sheet 74)
(Joins sheet 86)
AGASSIZ
NATIONAL
WILDLIFE
REFUGE
Madsen Pool
Agassiz Pool
Lansing Parker Pool
Thief River
Diversion
REFUGE
NATIONAL
BOUNDARY
water
w
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

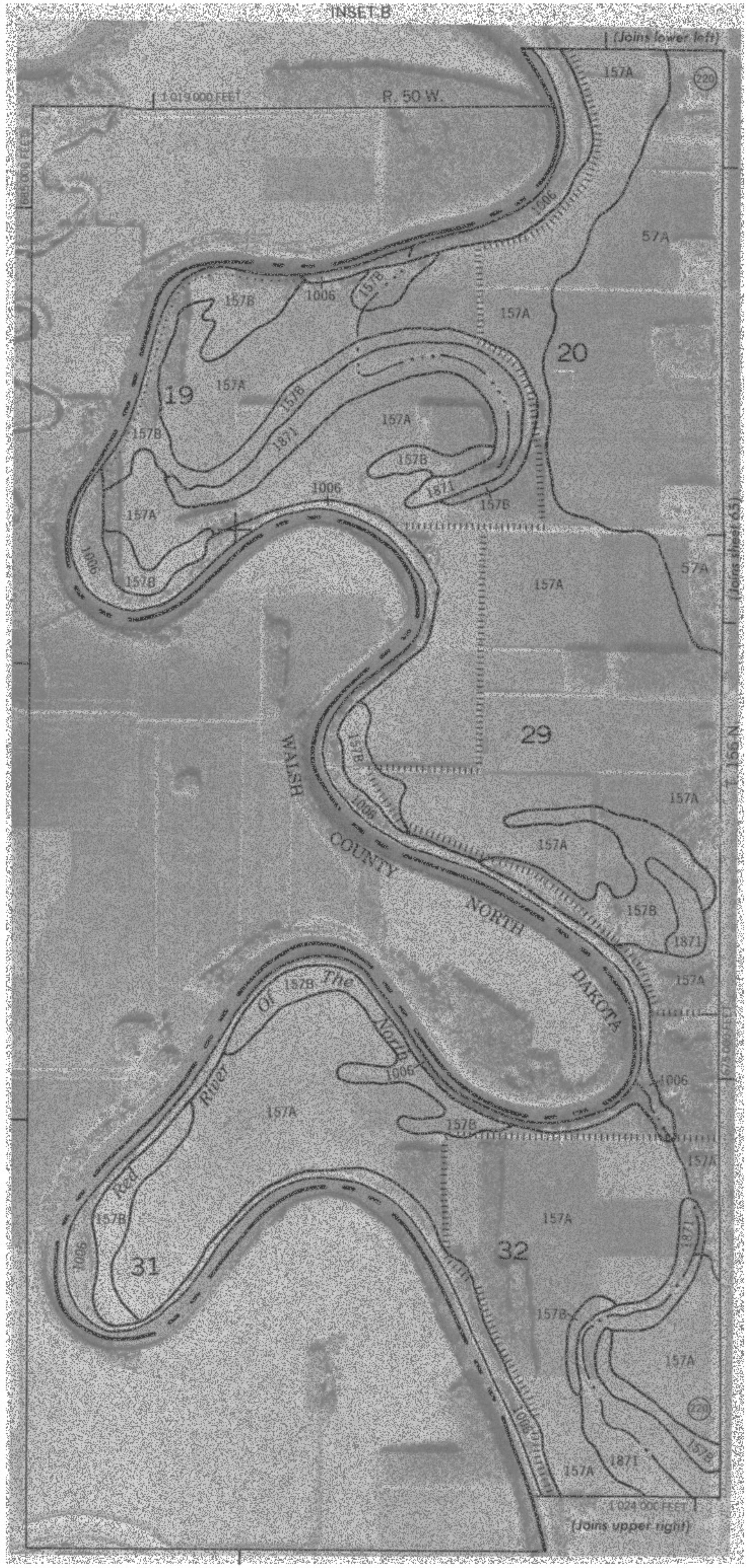
N

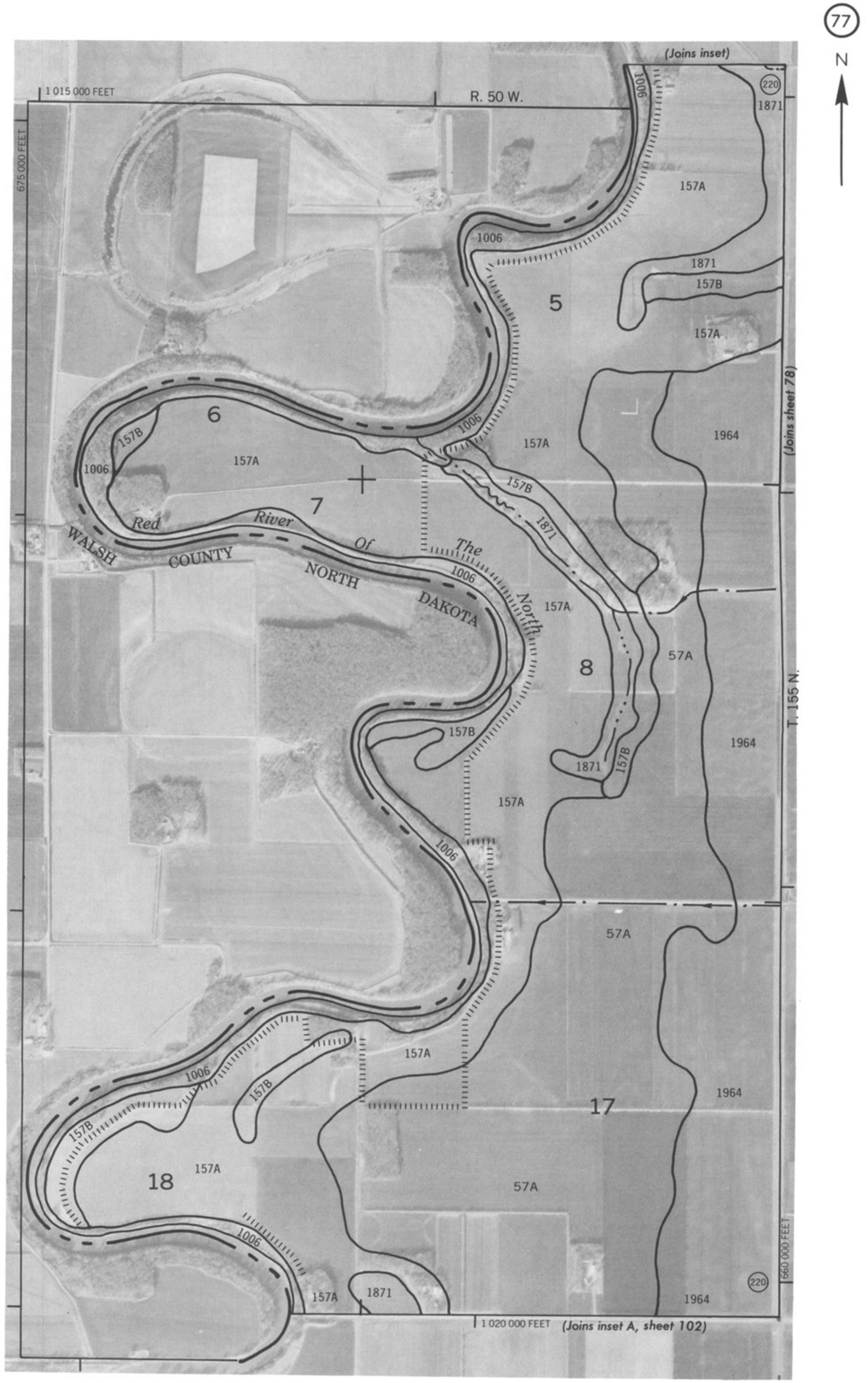

(Joins sheet 61)
R. 41 W.
325 000 FEET
Agassiz Pool
Headquarters Pool
South Pool
Lost Bay Pool
East Pool
Dahl Pool
AGASSIZ
NATIONAL
WILDLIFE
REFUGE
T. 156 N.
(Joins sheet 75)
(Joins sheet 73)
(Joins sheet 86)
(Joins sheet 87)
1 300 000 FEET
665 000 FEET
NATIONAL
REFUGE
BOUNDARY
water
w
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
1804
1807
1878
1187
1188
1031
544
540
582
387
236
280
432
650
653
713
765

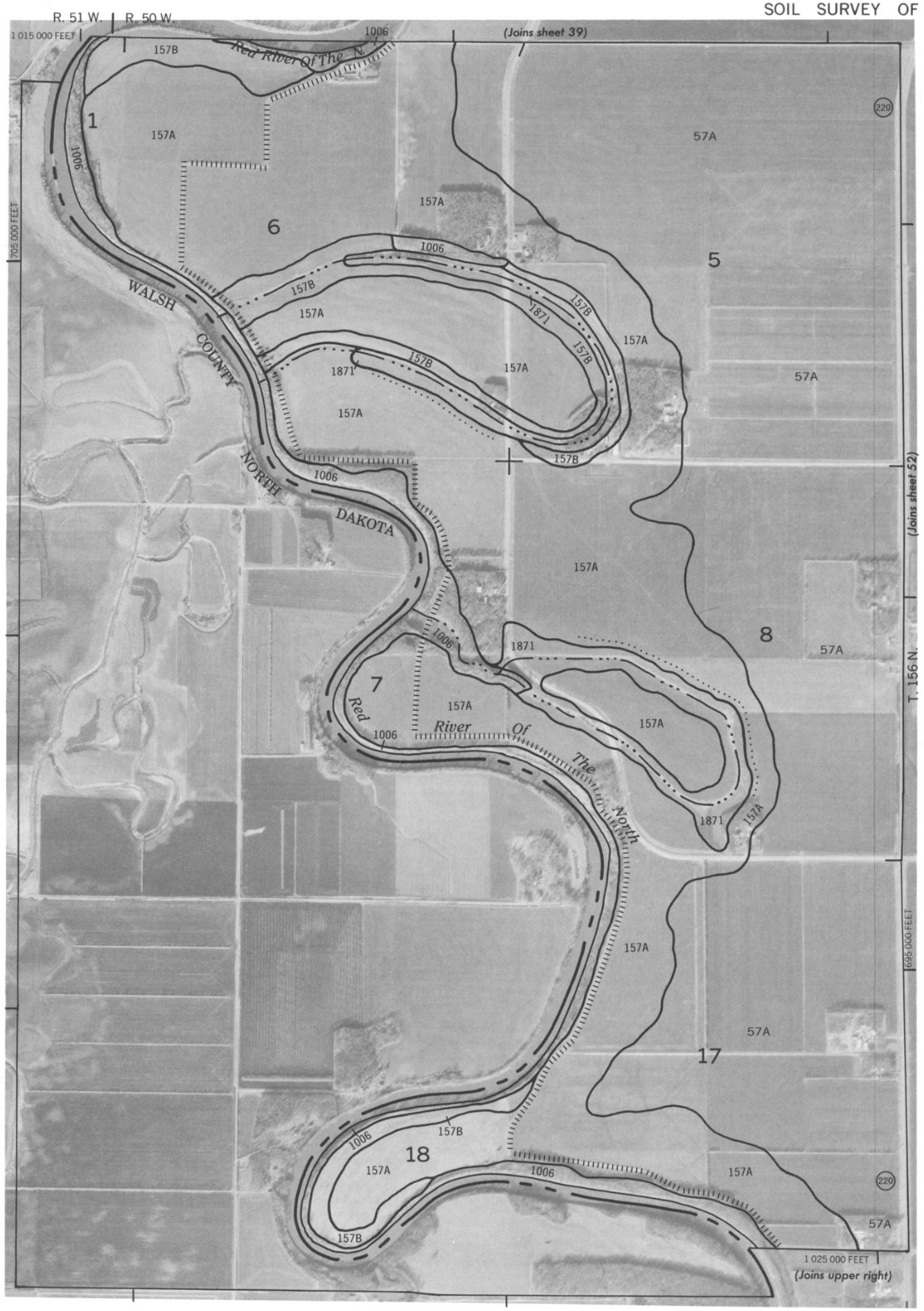

75
N
R. 41 W.
R. 40 W.
330 000 FEET
(Joins sheet 62)
Mud R.
(Joins sheet 74)
(Joins sheet 76)
(Joins sheet 88)
1 355 000 FEET
679 000 FEET
T. 156 N.
water
AGASSIZ
NATIONAL
WILDLIFE
REFUGE
BOUNDARY
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
89
219
765
1804
1807
1878
653
650
280
439
481
563
565
59
582
432
1144
1143
1146
547
544
236
412
387
649
77
1006


N
(Joins sheet 63)
R. 40 W.
R. 39 W.
Mud River
(Joins sheet 75)
(Joins inset A, sheet 64)
(Joins sheet 89)
T. 156 N.
1 385 000 FEET
1 360 000 FEET
675 000 FEET
665 000 FEET
GRYGLA
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
89
219

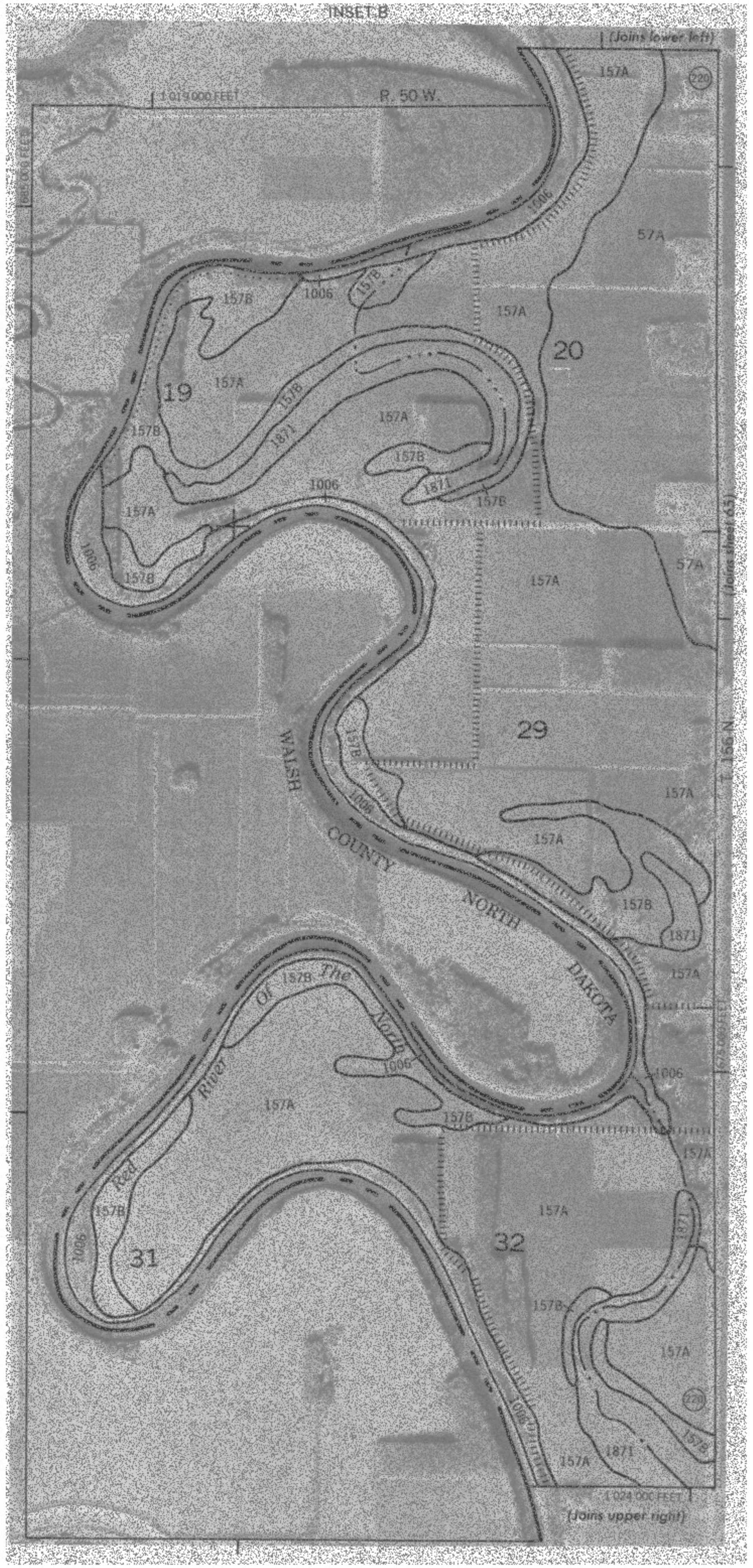

R. 51 W.
R. 50 W.
1 015 000 FEET
(Joins sheet 39)
Red River Of The North
(Joins sheet 52)
T. 156 N.
WALSH COUNTY NORTH DAKOTA
Red River Of The North
1 025 000 FEET
(Joins upper right)
220
1
5
6
7
8
17
18
157A
157B
57A
1006
1871

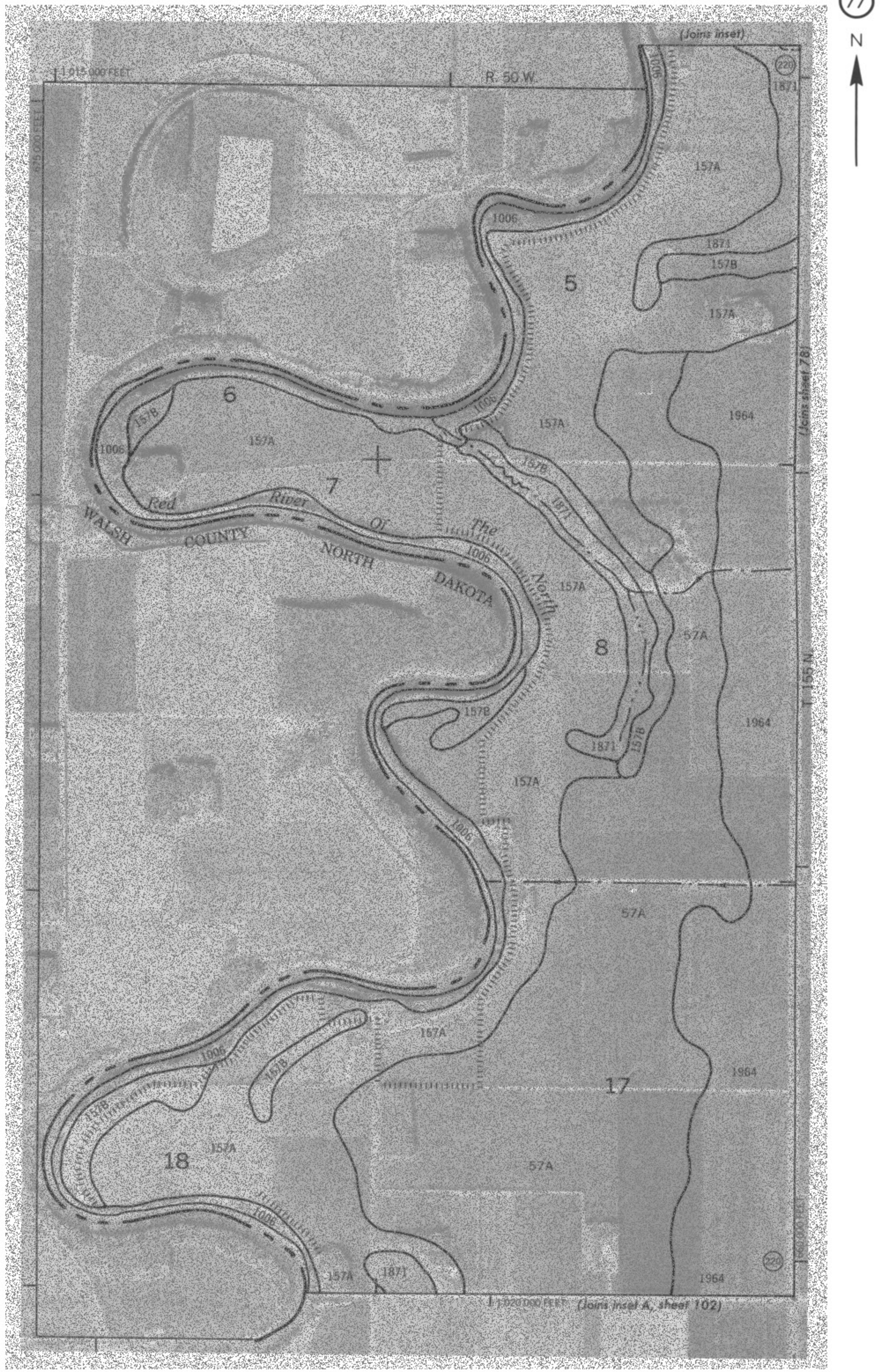

INSET B
(Joins lower left)
1 019 000 FEET
R. 50 W.
(Joins sheet 53)
T. 156 N.
WALSH COUNTY NORTH DAKOTA
Red River Of The North
1 024 000 FEET
(Joins upper right)
220
19
20
29
31
32
157A
157B
57A
1006
1871


77
N
(Joins inset)
1 015 000 FEET
R. 50 W.
675 000 FEET
(Joins sheet 78)
T. 155 N.
WALSH COUNTY NORTH DAKOTA
Red River Of The North
660 000 FEET
1 020 000 FEET
(Joins inset A, sheet 102)
220
5
6
7
8
17
18
157A
157B
57A
1006
1871
1964

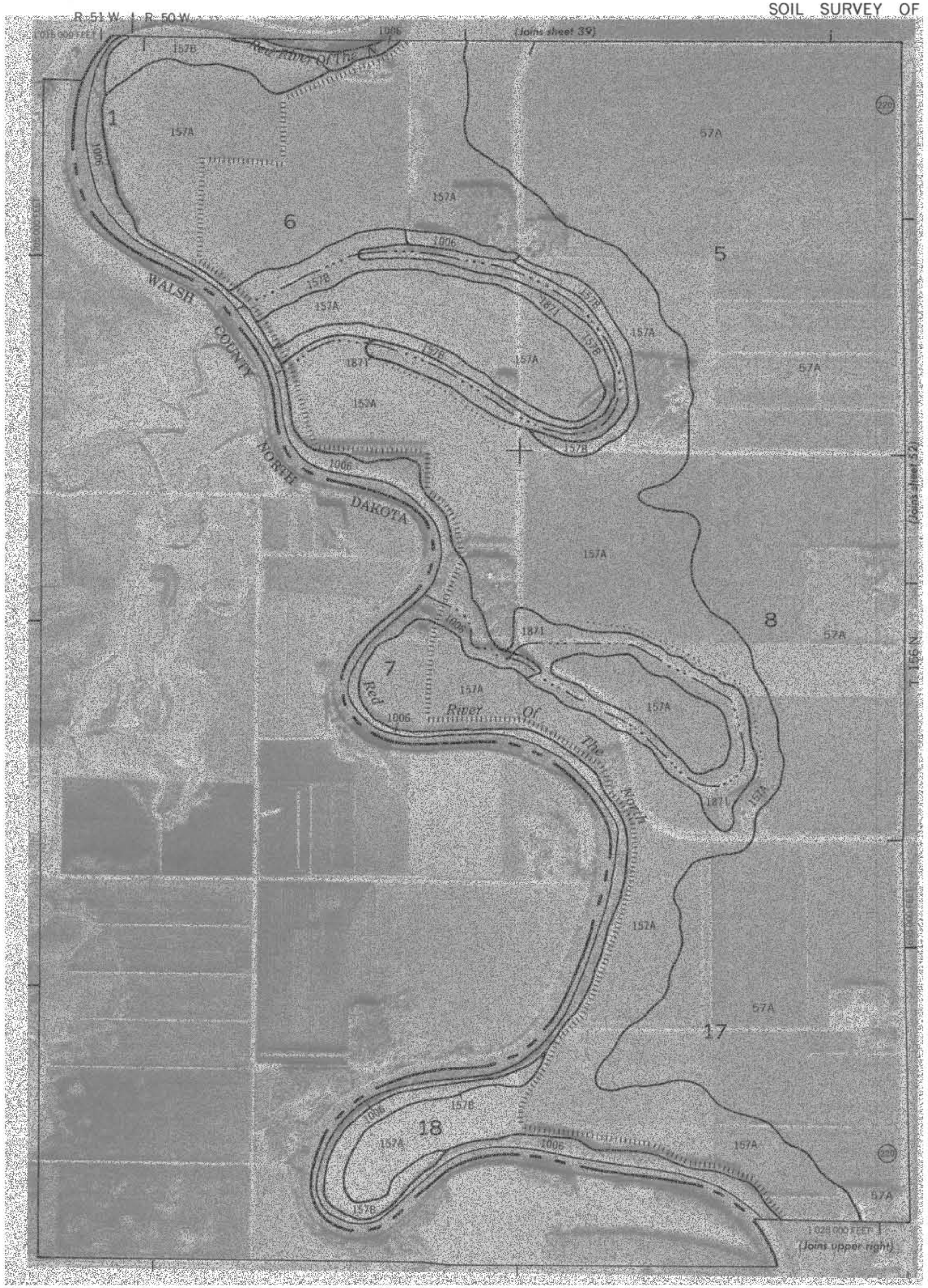

R. 51 W.
R. 50 W.
1 015 000 FEET
(Joins sheet 39)
Red River Of The North
WALSH COUNTY
NORTH DAKOTA
705 000 FEET
(Joins sheet 52)
T. 156 N.
695 000 FEET
1 025 000 FEET
(Joins upper right)
1
5
6
7
8
17
18
157A
157B
57A
1006
1871
220

INSET B

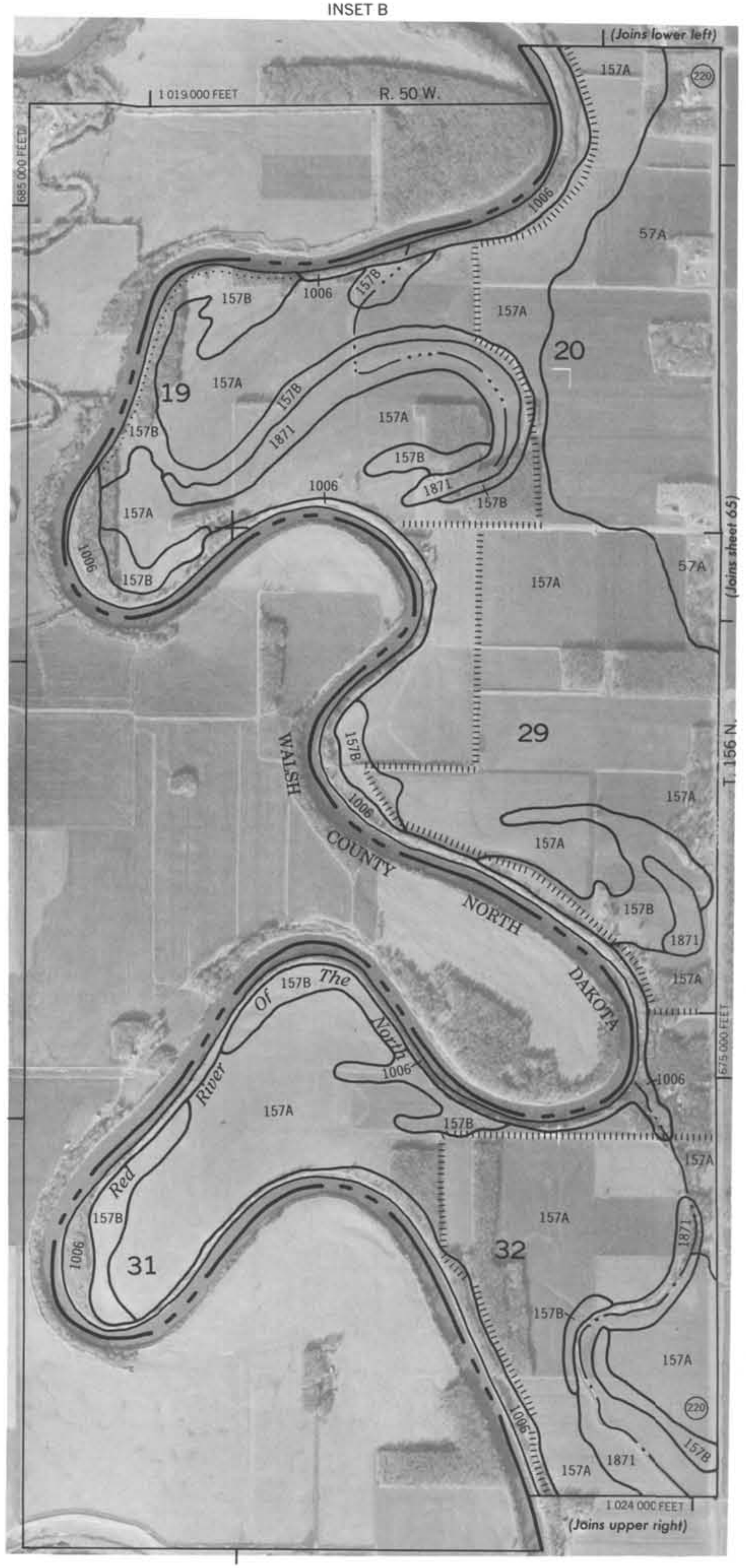

(Joins lower left)
1 019 000 FEET
R. 50 W.
Red River Of The North
WALSH COUNTY
NORTH DAKOTA
(Joins sheet 53)
T. 156 N.
1 024 000 FEET
(Joins upper right)
19
20
29
31
32
157A
157B
57A
1006
1871
220

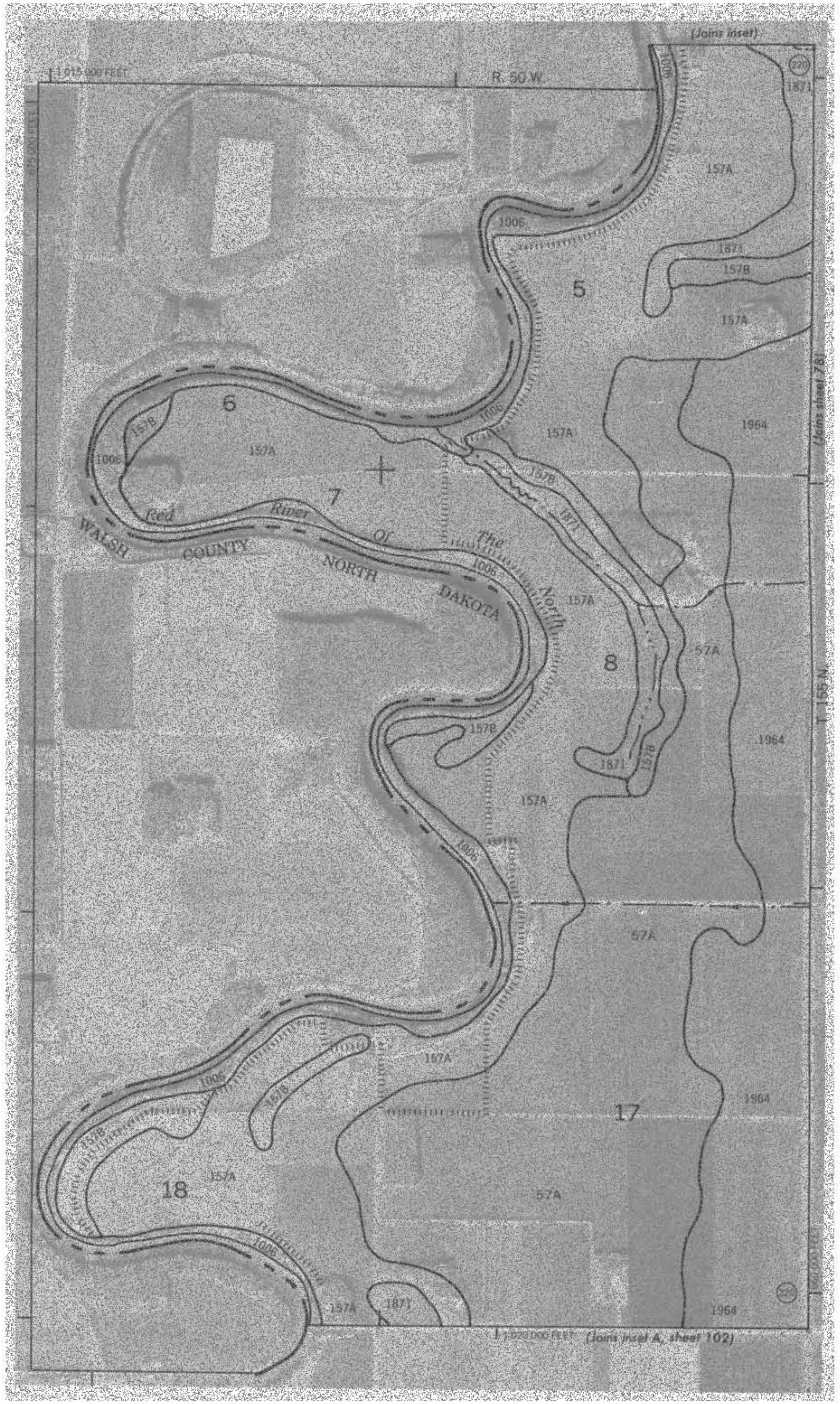

N
(Joins inset)
1 015 000 FEET
R. 50 W.
Red River Of The North
WALSH COUNTY
NORTH DAKOTA
(Joins sheet 78)
T. 156 N.
1 020 000 FEET
(Joins inset A, sheet 102)
5
6
7
8
17
18
157A
157B
57A
1006
1871
1964
220

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 77


R. 51 W.
R. 50 W.
1 015 000 FEET
(Joins sheet 39)
Red Lake Of The N
1006
157B
157A
57A
1
6
5
220
WALSH
COUNTY
NORTH
DAKOTA
1871
7
8
Red
River
Of
The
North
17
18
152A
(Joins sheet 52)
T. 166 N.
1 025 000 FEET
(Joins upper right)

INSET B

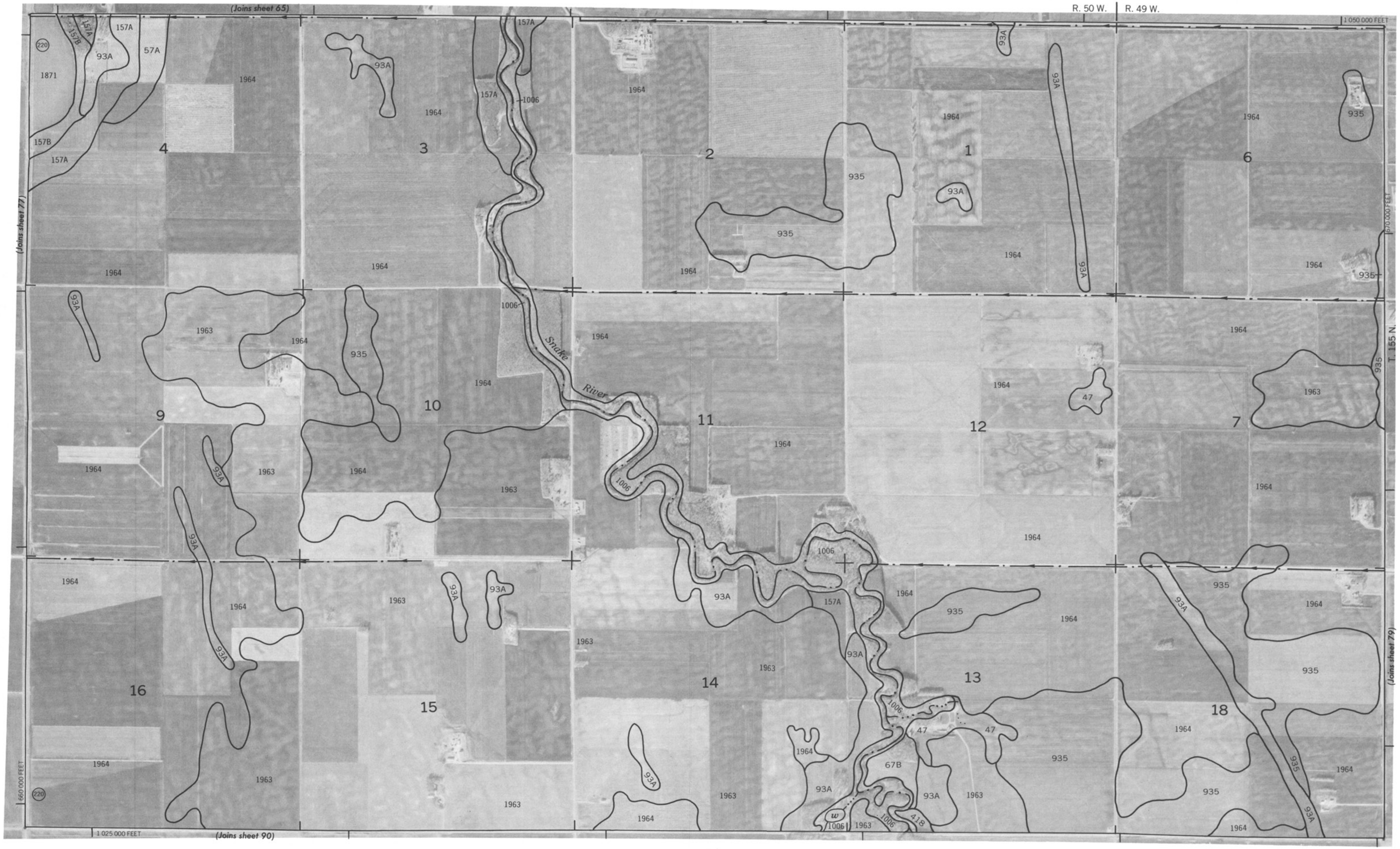

(Joins lower left)
1 019 000 FEET
R. 50 W.
685 000 FEET
220
157A
57A
157B
1006
1871
19
20
29
31
32
WALSH
COUNTY
NORTH
DAKOTA
Red
River
Of
The
North
(Joins sheet 65)
T. 166 N.
675 000 FEET
1 024 000 FEET
(Joins upper right)

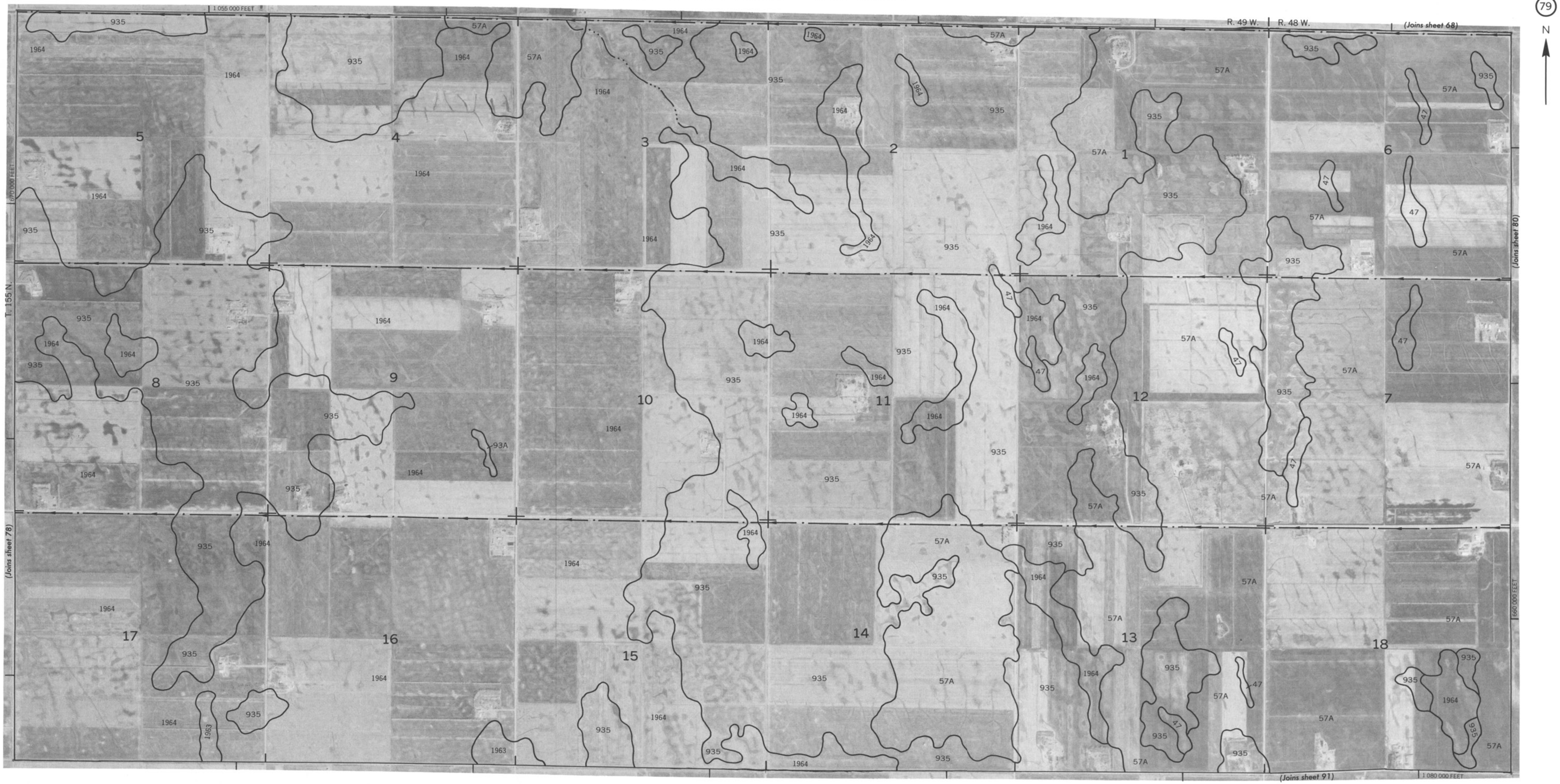

(Joins inset)
1 015 000 FEET
R. 50 W.
220
1871
157A
157B
1006
5
6
7
8
17
18
Red
River
Of
The
North
WALSH
COUNTY
NORTH
DAKOTA
57A
1964
(Joins sheet 78)
T. 155 N.
1 020 000 FEET
(Joins inset A, sheet 102)

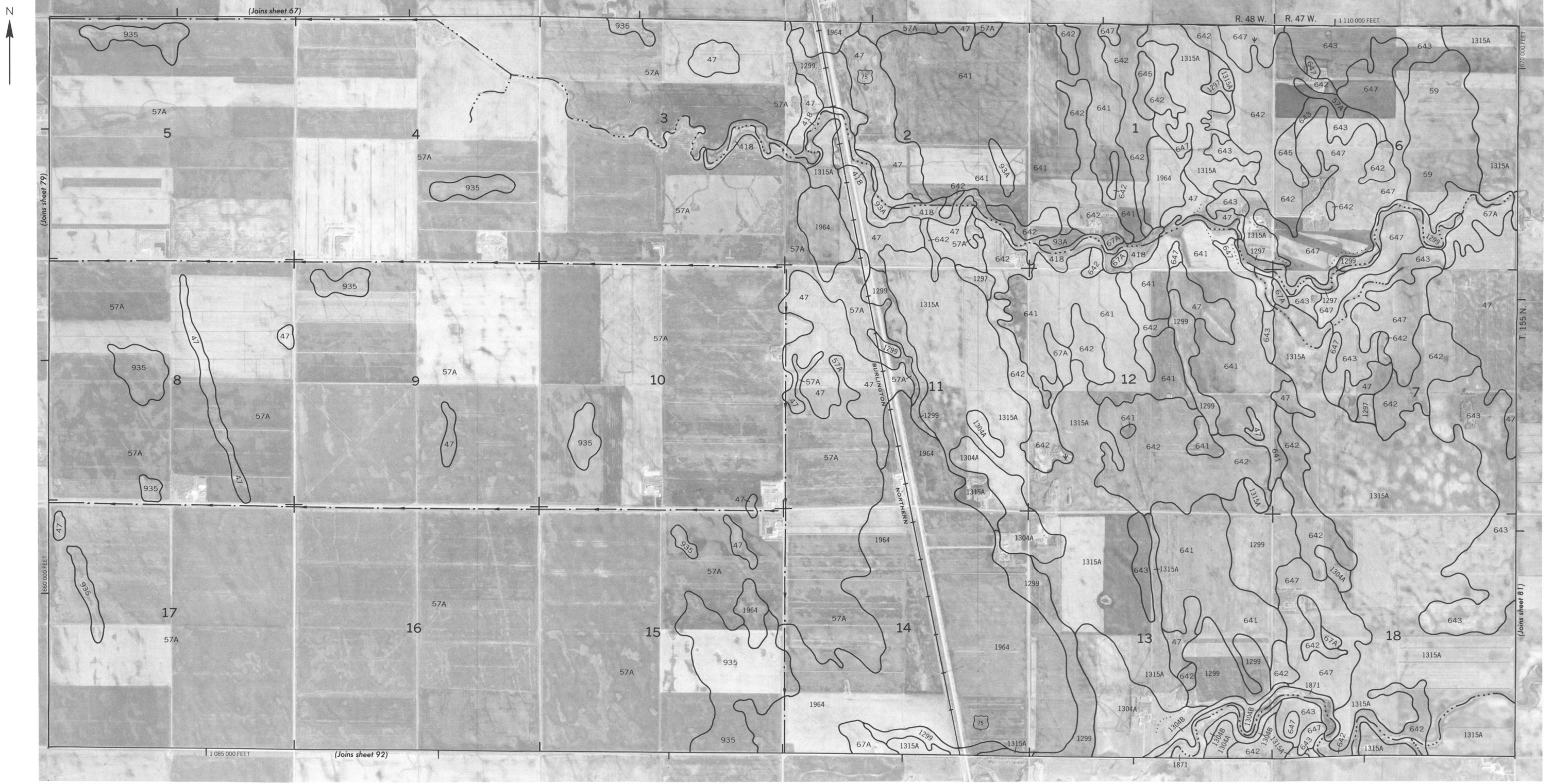
78

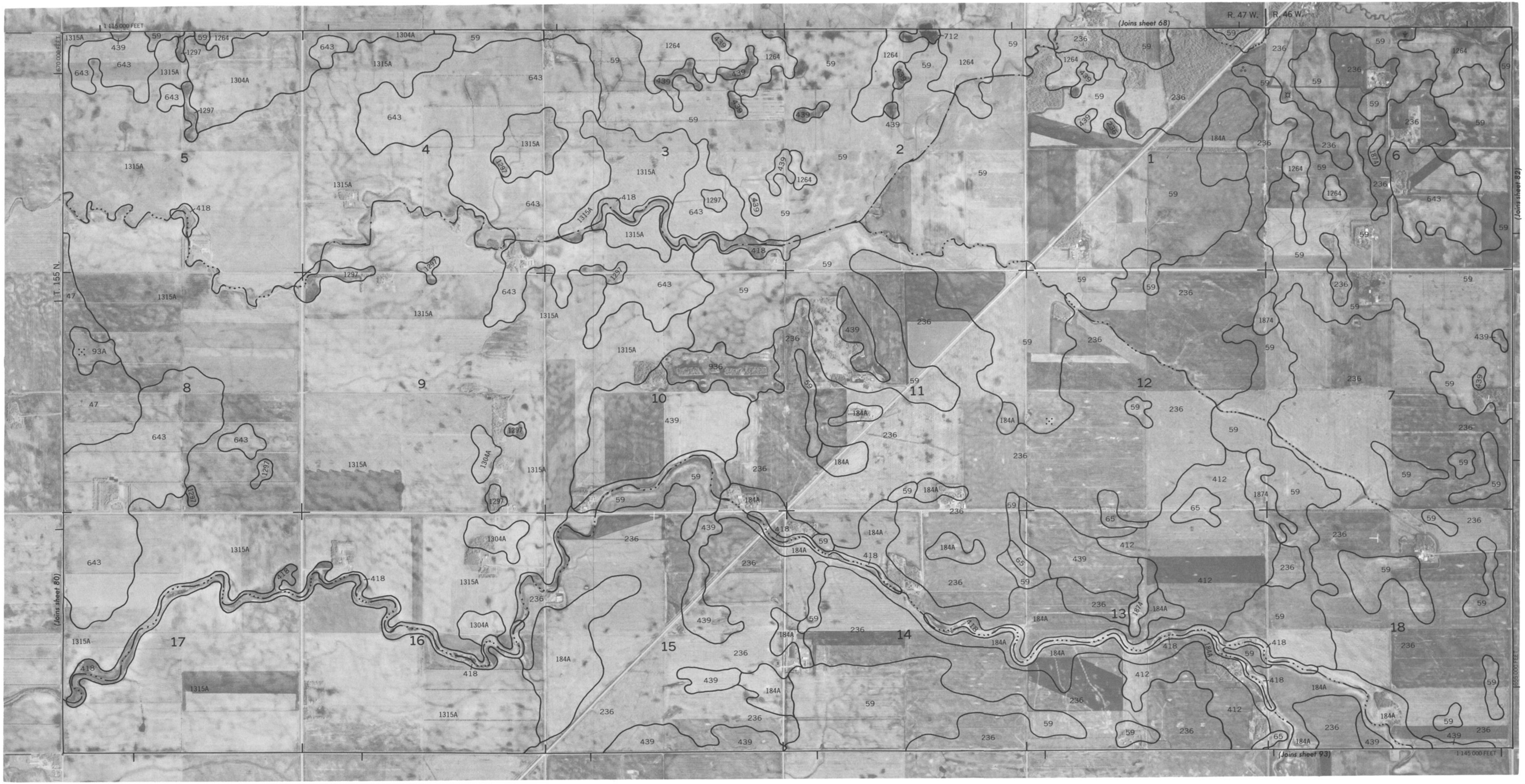
N

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 78


(Joins sheet 65)
R. 50 W.
R. 49 W.
1 050 000 FEET
(Joins sheet 77)
T. 155 N.
670 000 FEET
(Joins sheet 79)
660 000 FEET
1 025 000 FEET
(Joins sheet 90)
220
220
1871
157A
157B
57A
93A
1964
1963
935
1006
47
67B
418
w
Snake River
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18

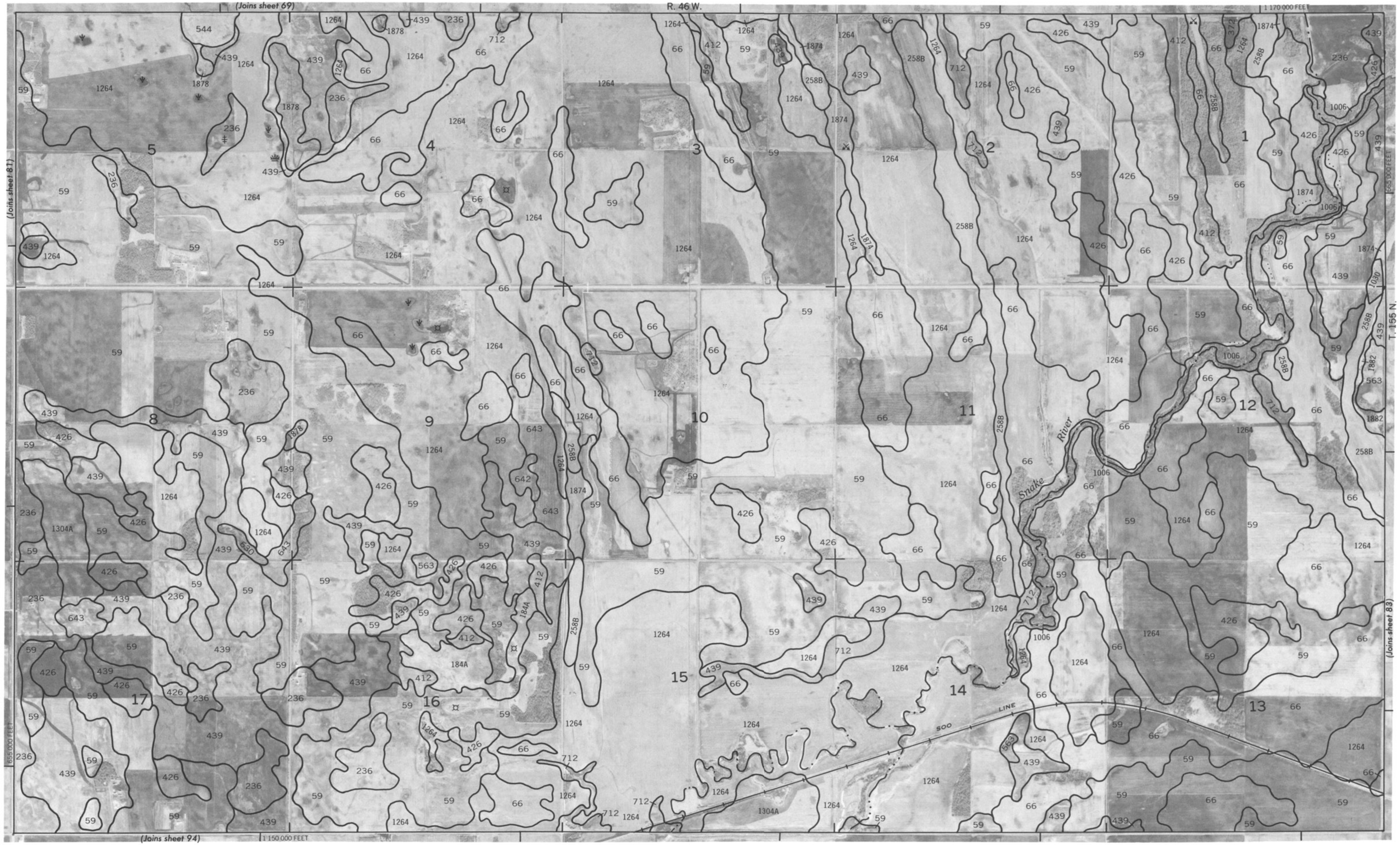

N
1 055 000 FEET
1 080 000 FEET
670 000 FEET
660 000 FEET
R. 49 W.
R. 48 W.
T. 155 N.
(Joins sheet 68)
(Joins sheet 80)
(Joins sheet 91)
(Joins sheet 78)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
935
1964
1963
57A
47
93A

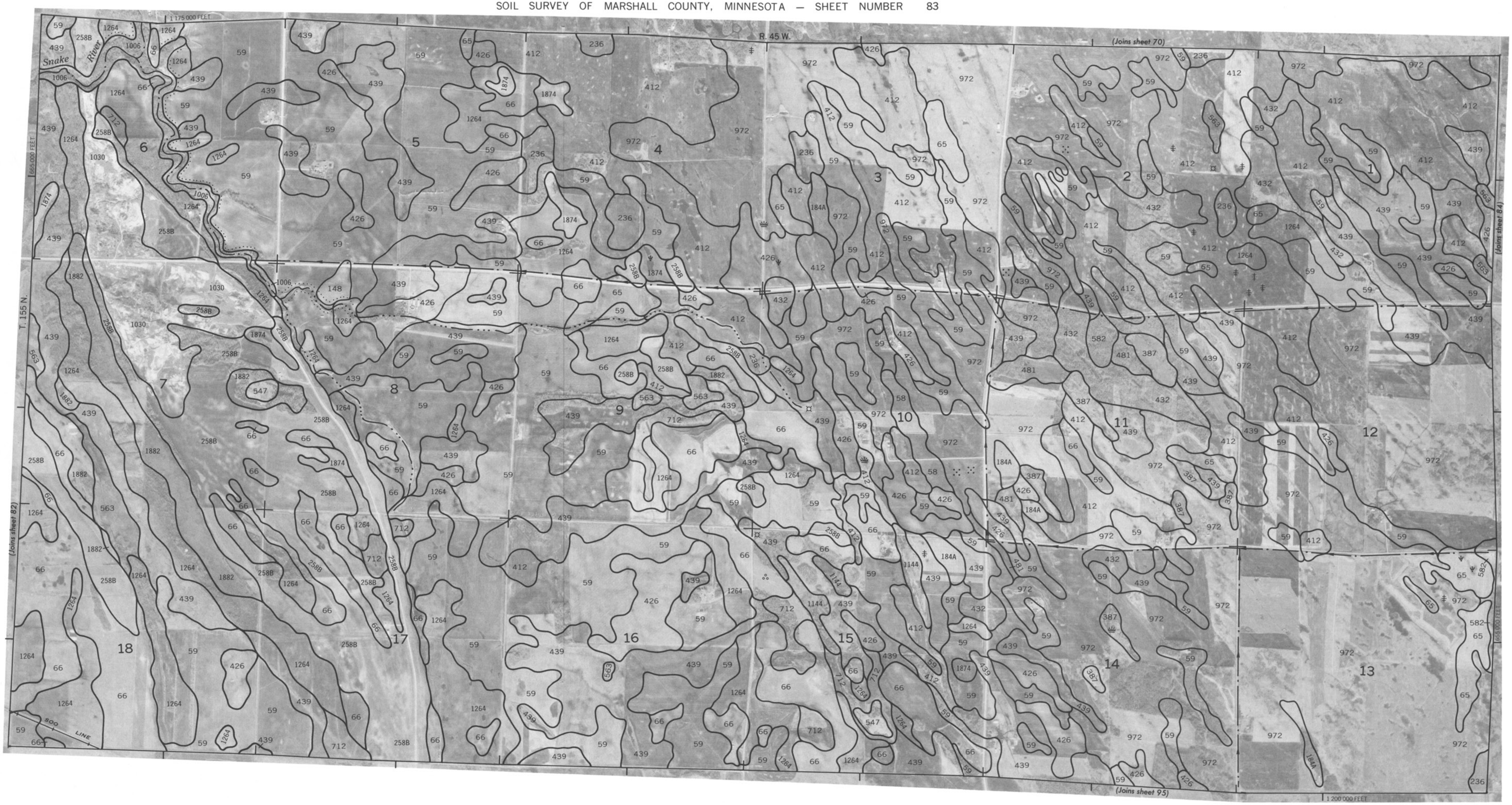

N
(Joins sheet 67)
(Joins sheet 79)
(Joins sheet 81)
(Joins sheet 92)
R. 48 W.
R. 47 W.
T. 155 N.
1 110 000 FEET
670 000 FEET
660 000 FEET
1 085 000 FEET
BURLINGTON
NORTHERN
75
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
47
57A
59
67A
93A
418
641
642
643
645
647
935
1297
1299
1304A
1304B
1315A
1871
1964


(Joins sheet 68)
R. 47 W.
R. 46 W.
(Joins sheet 82)
(Joins sheet 93)
(Joins sheet 80)
T. 155 N.
1 115 000 FEET
670 000 FEET
1 145 000 FEET
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
1315A
1304A
1297
1264
643
439
59
712
236
184A
1874
418
412
65
47
93A
936

81
N

N


(Joins sheet 69)
R. 46 W.
1 170 000 FEET
(Joins sheet 81)
(Joins sheet 83)
(Joins sheet 94)
1 150 000 FEET
655 000 FEET
T. 155 N.
Snake River
SOO LINE
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
59
66
184A
236
258B
372
412
426
439
544
563
630
642
643
712
1006
1264
1304A
1874
1878
1882


N
1 175 000 FEET
R. 45 W.
(Joins sheet 70)
(Joins sheet 84)
(Joins sheet 95)
(Joins sheet 82)
T. 155 N.
665 000 FEET
1 200 000 FEET
Snake River
SOO LINE
1
2
3
4
5
6
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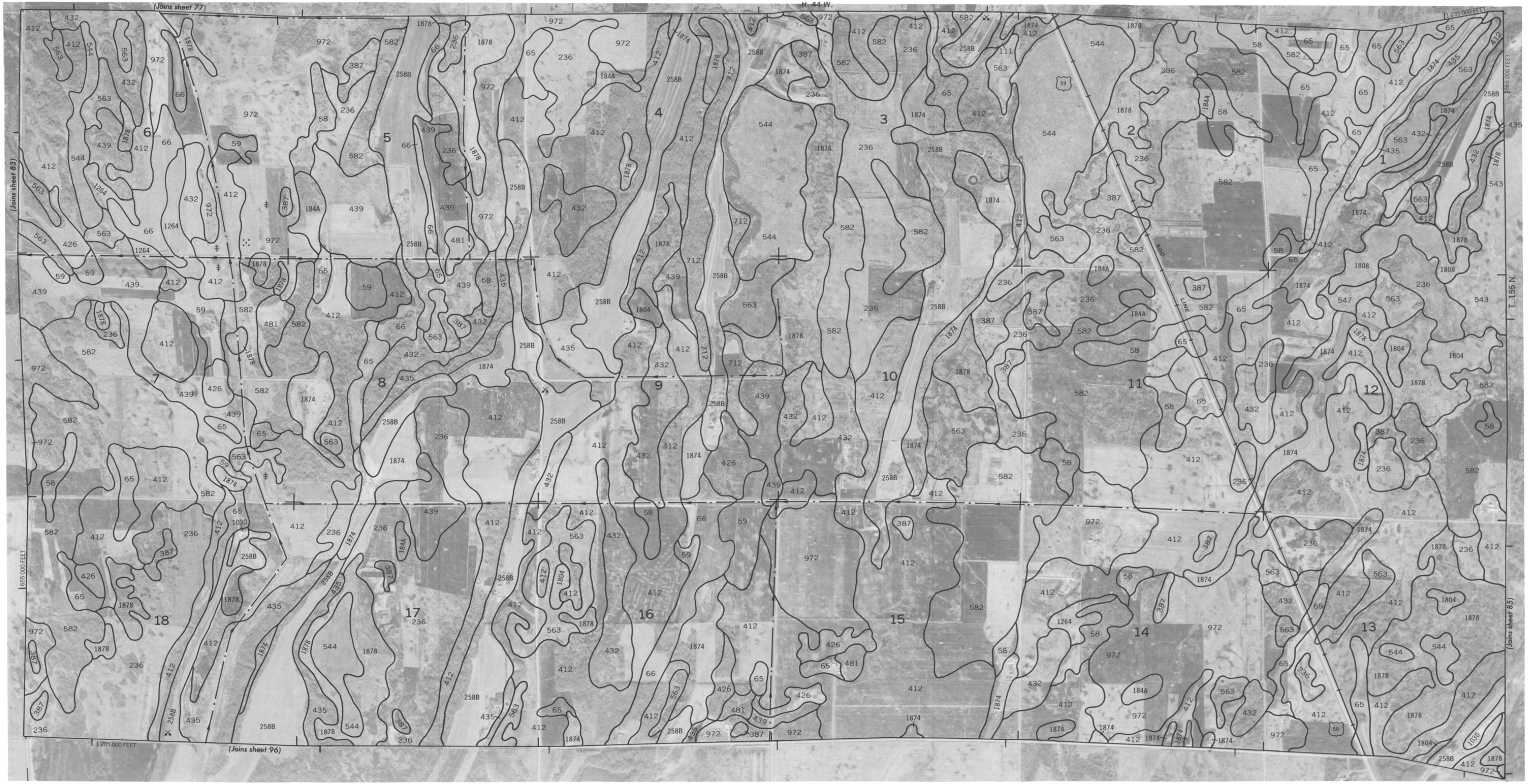
8
9
10
11
12
13
14
15
16
17
18

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 84


N
(Joins sheet 77)
R. 44 W.
(Joins sheet 83)
(Joins sheet 85)
(Joins sheet 96)
T. 155 N.
235 000 FEET
655 000 FEET
1 205 000 FEET
59
LINE
1
2
3
4
5
6
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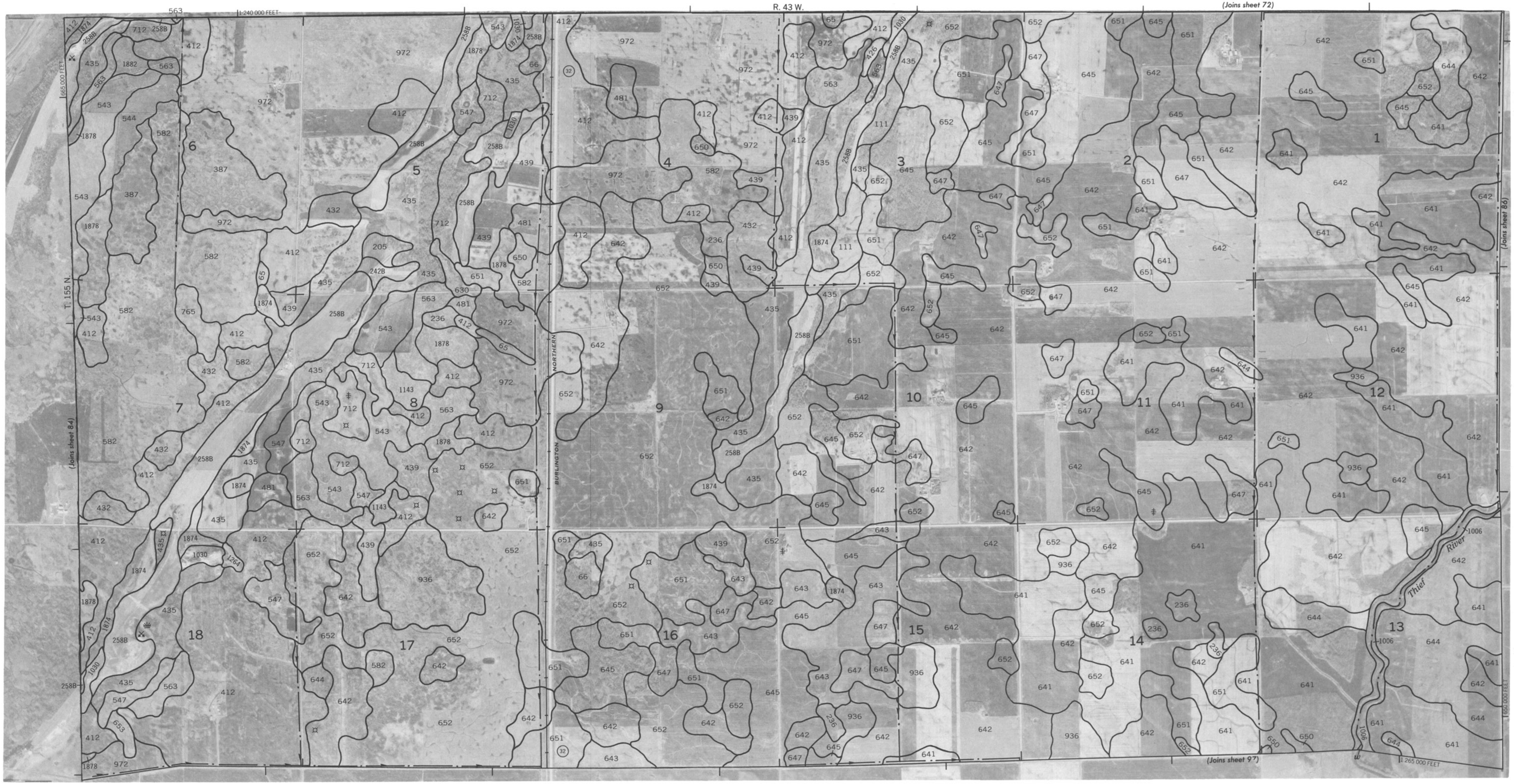
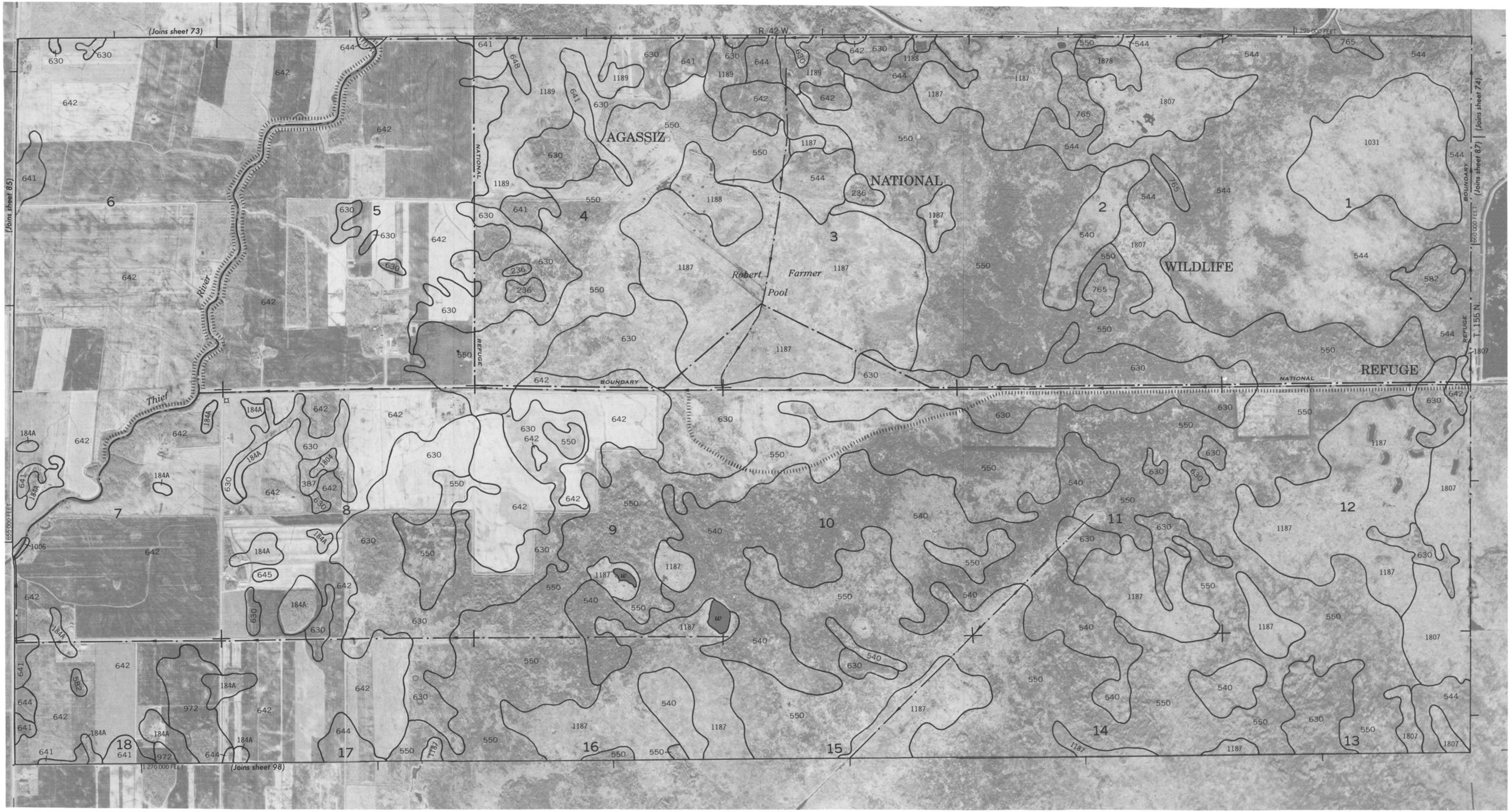
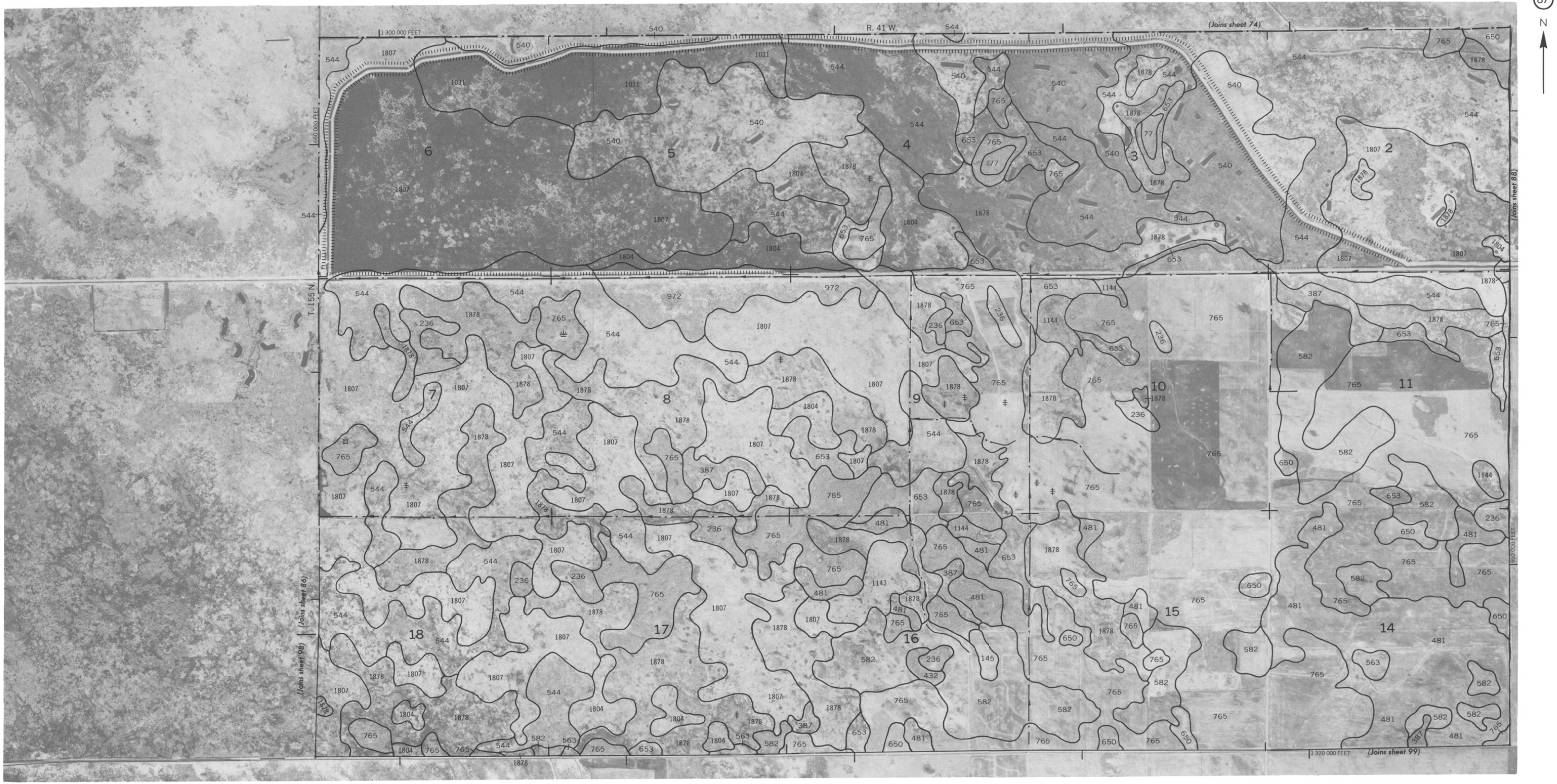
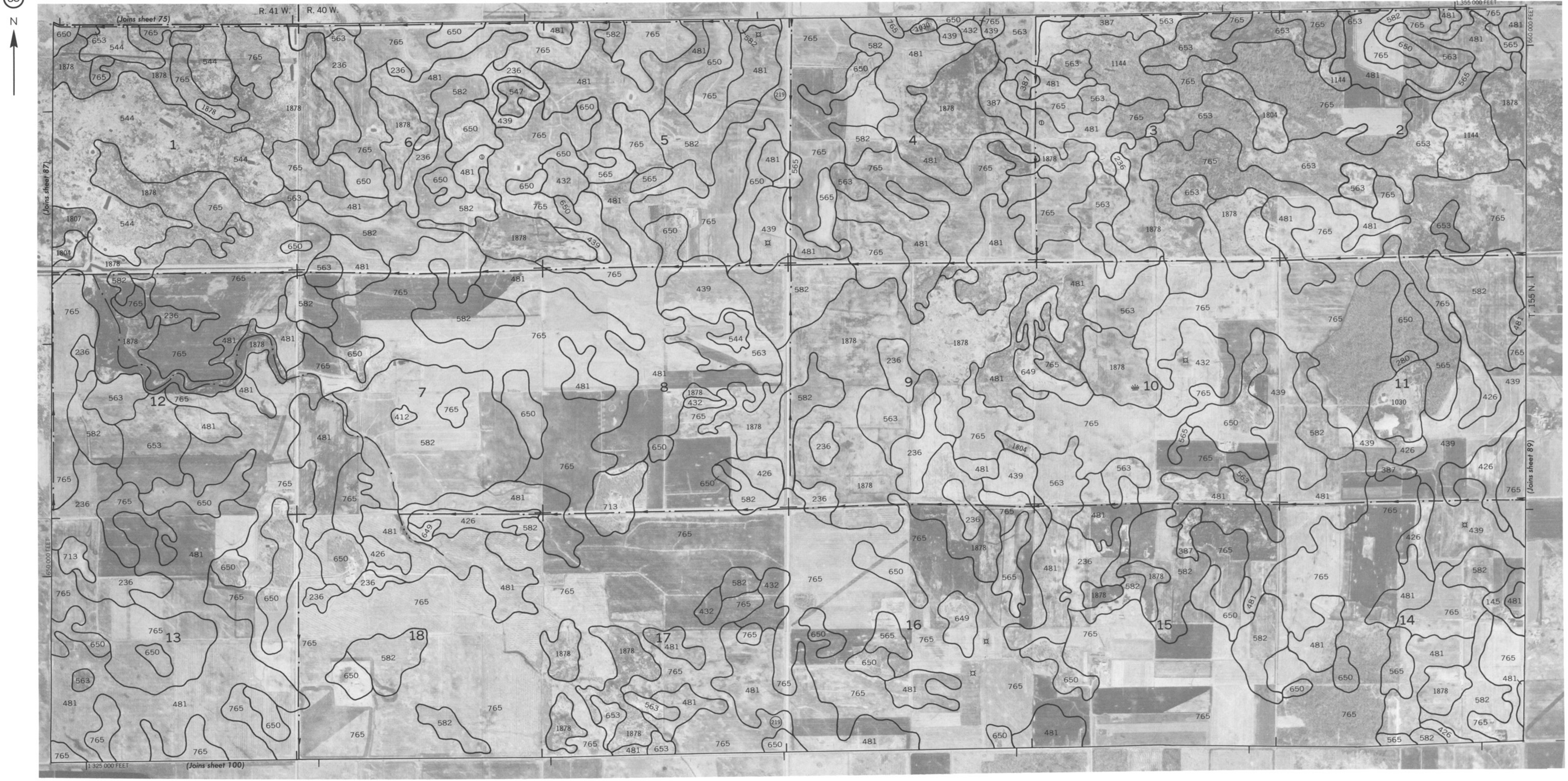
8
9
10
11
12
13
14
15
16
17
18

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 85


(Joins sheet 72)
R. 43 W.
1 240 000 FEET
665 000 FEET
T. 155 N.
(Joins sheet 84)
(Joins sheet 86)
(Joins sheet 97)
1 265 000 FEET
660 000 FEET
NORTHERN
BURLINGTON
32
Thief River
N
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18


N
(Joins sheet 73)
R. 42 W.
1 295 000 FEET
(Joins sheet 74)
(Joins sheet 87)
(Joins sheet 85)
(Joins sheet 98)
T. 155 N.
BOUNDARY
600 000 FEET
655 000 FEET
1 270 000 FEET
AGASSIZ
NATIONAL
WILDLIFE
REFUGE
NATIONAL
REFUGE
BOUNDARY
Robert
Farmer
Pool
Thief
River
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
184A
236
387
540
544
550
582
630
641
642
644
645
648
765
972
1006
1031
1187
1188
1189
1804
1807
1878
w


N
R. 41 W.
T. 155 N
(Joins sheet 74)
(Joins sheet 88)
(Joins sheet 99)
(Joins sheet 86)
(Joins sheet 98)
1 300 000 FEET
660 000 FEET
1 320 000 FEET
650 000 FEET
1
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18


N
R. 41 W.
R. 40 W.
(Joins sheet 75)
1 355 000 FEET
560 000 FEET
(Joins sheet 87)
T. 155 N.
(Joins sheet 89)
650 000 FEET
1 325 000 FEET
(Joins sheet 100)
1
2
3
4
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10
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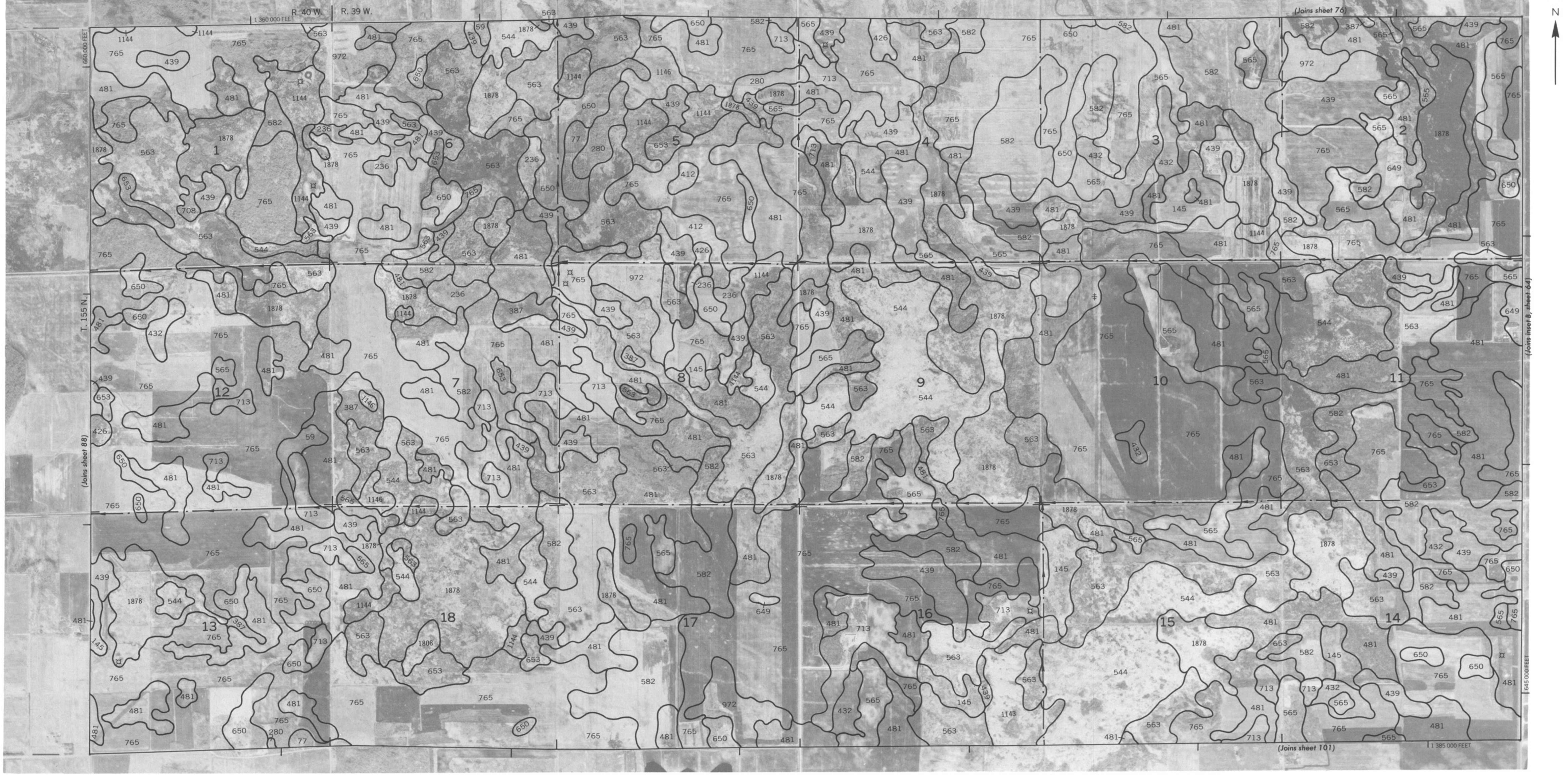
12
13
14
15
16
17
18
219


N
R. 40 W.
R. 39 W.
1 360 000 FEET
660 000 FEET
(Joins sheet 76)
T. 155 N.
(Joins sheet 88)
(Joins inset B, sheet 64)
645 000 FEET
(Joins sheet 101)
1 385 000 FEET
1
2
3
4
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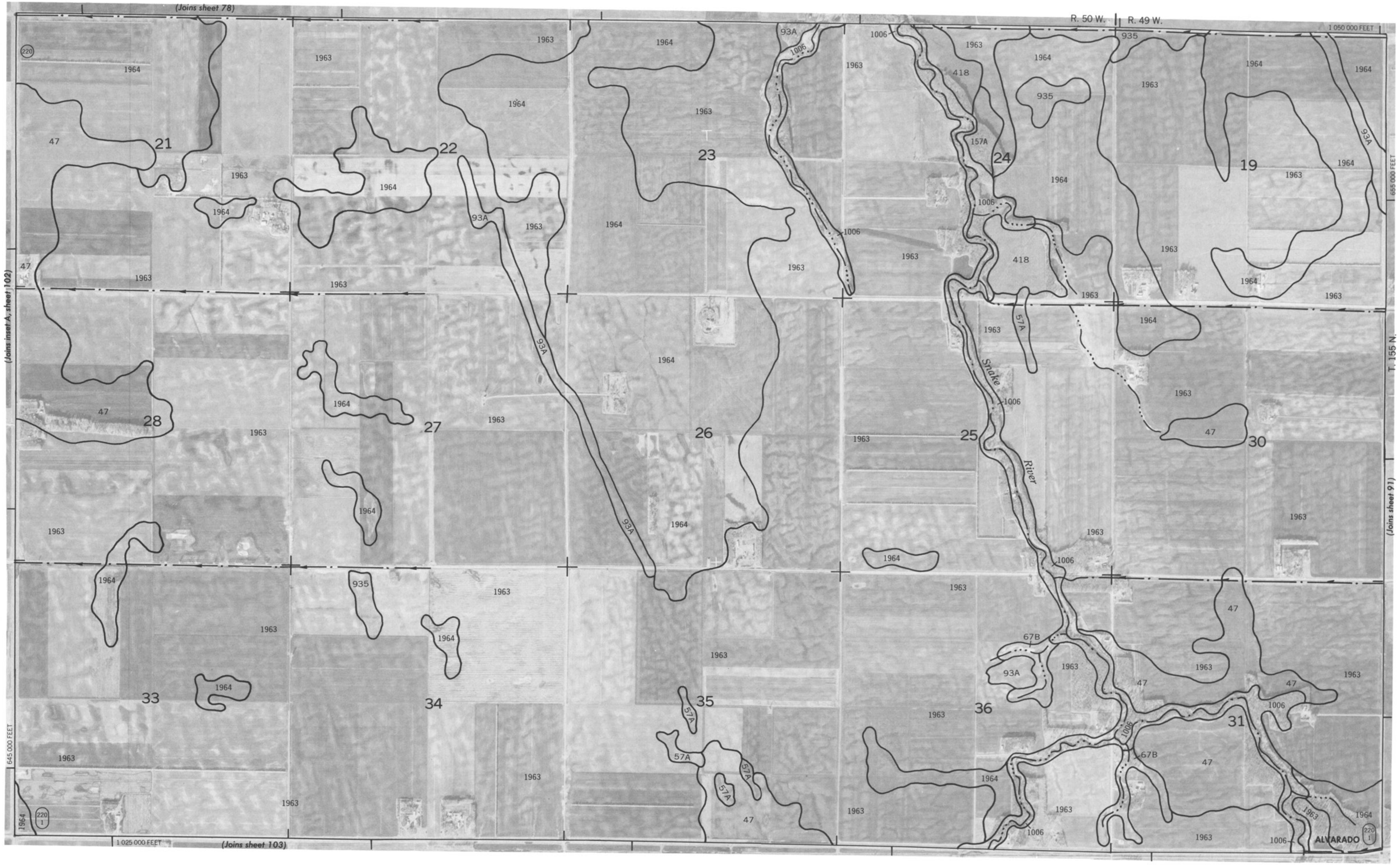
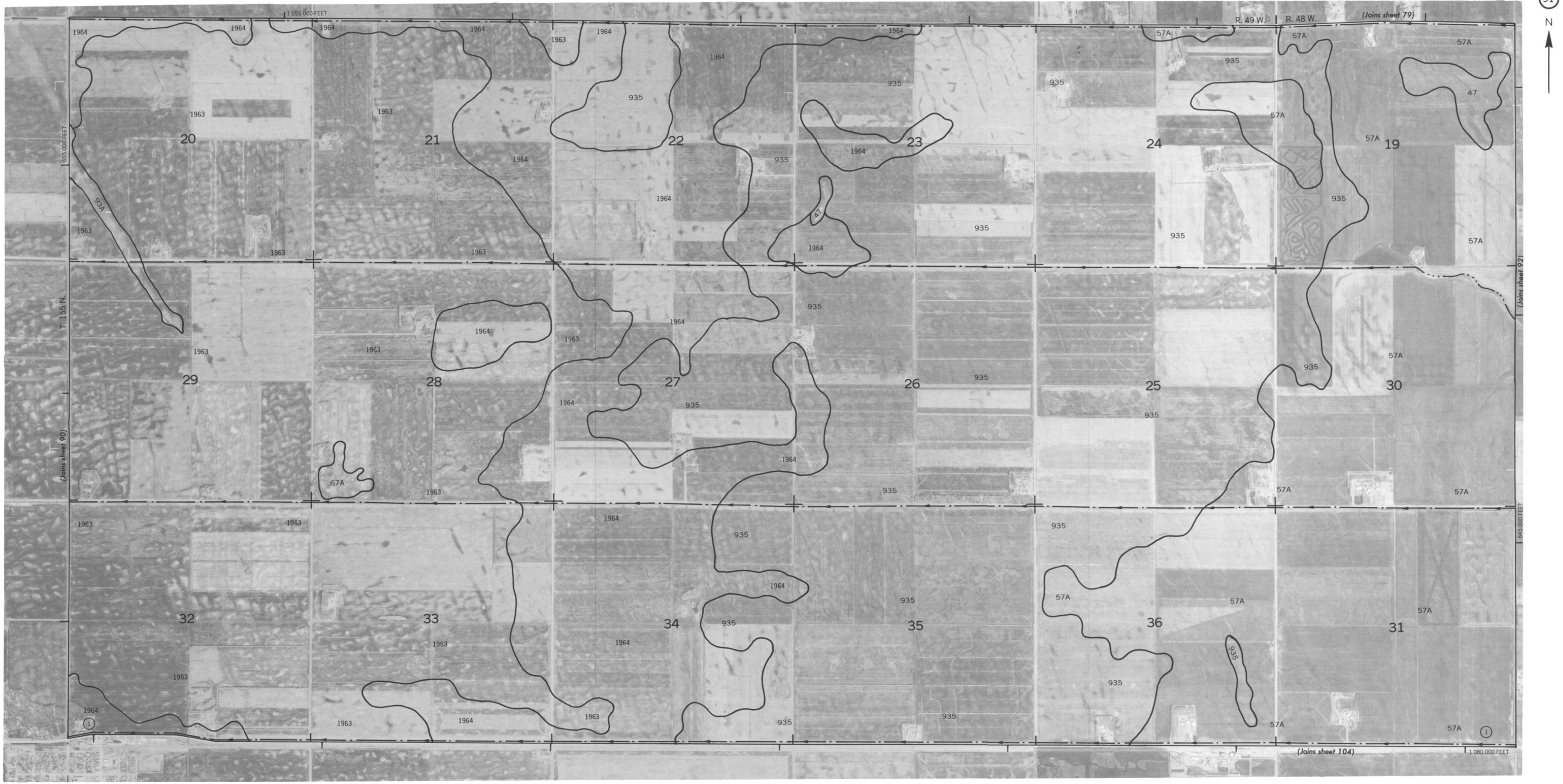
16
17
18

N

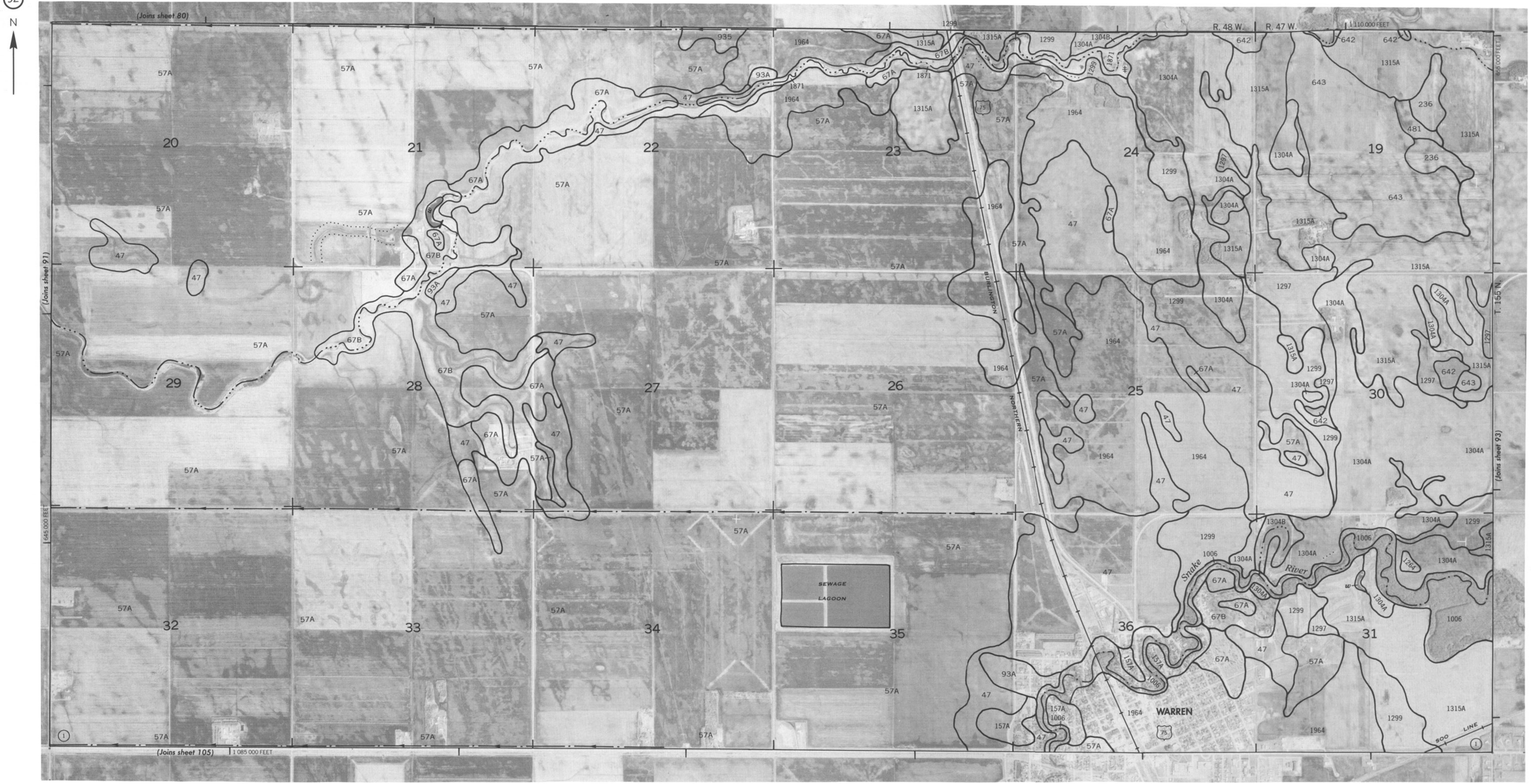
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 90

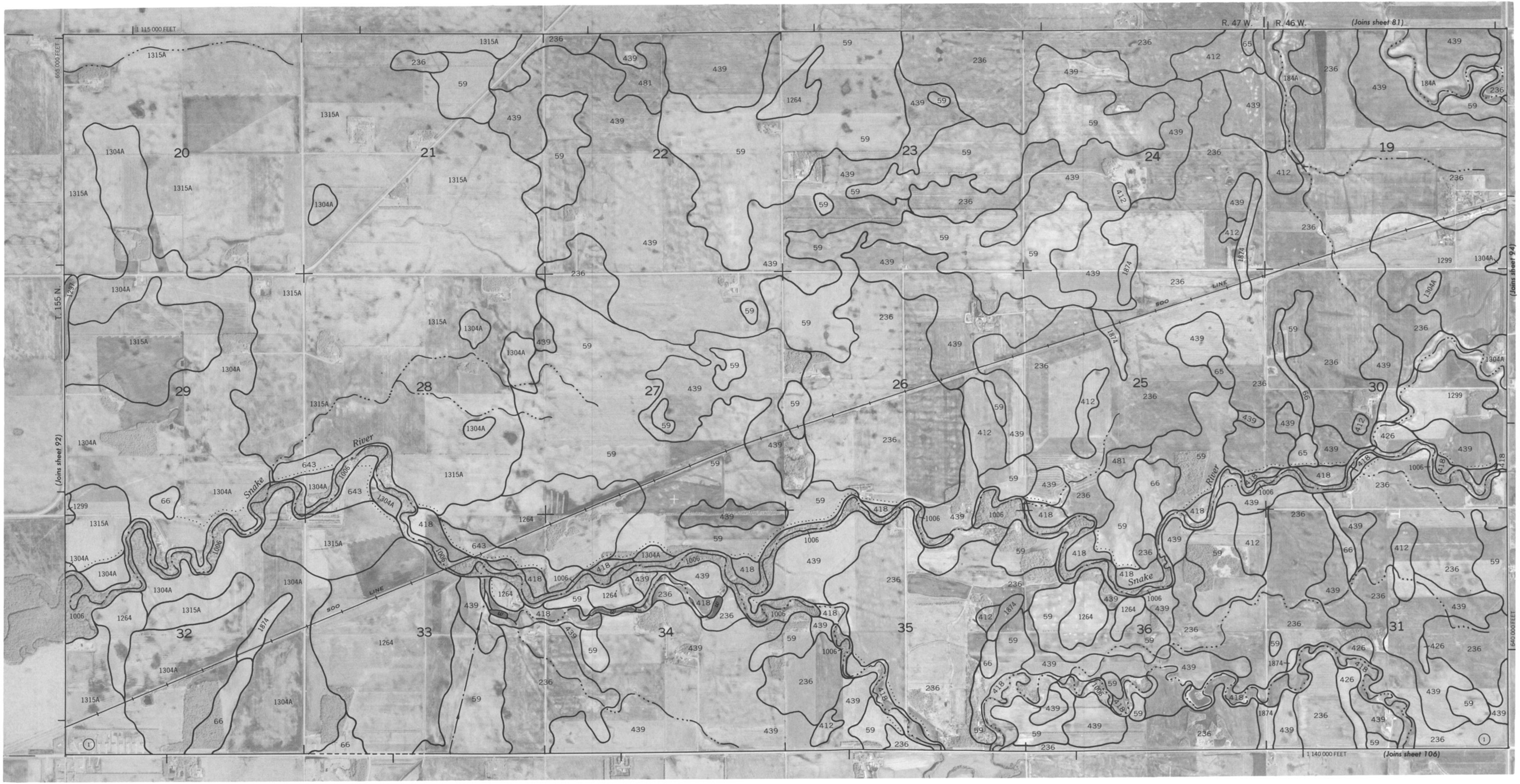

(Joins sheet 78)
R. 50 W.
R. 49 W.
1 050 000 FEET
655 000 FEET
T. 155 N.
(Joins sheet 91)
(Joins inset A, sheet 102)
645 000 FEET
1 025 000 FEET
(Joins sheet 103)
ALVARADO
Snake
River
220
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
47
93A
1006
418
935
157A
57A
67B
1963
1964

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 91

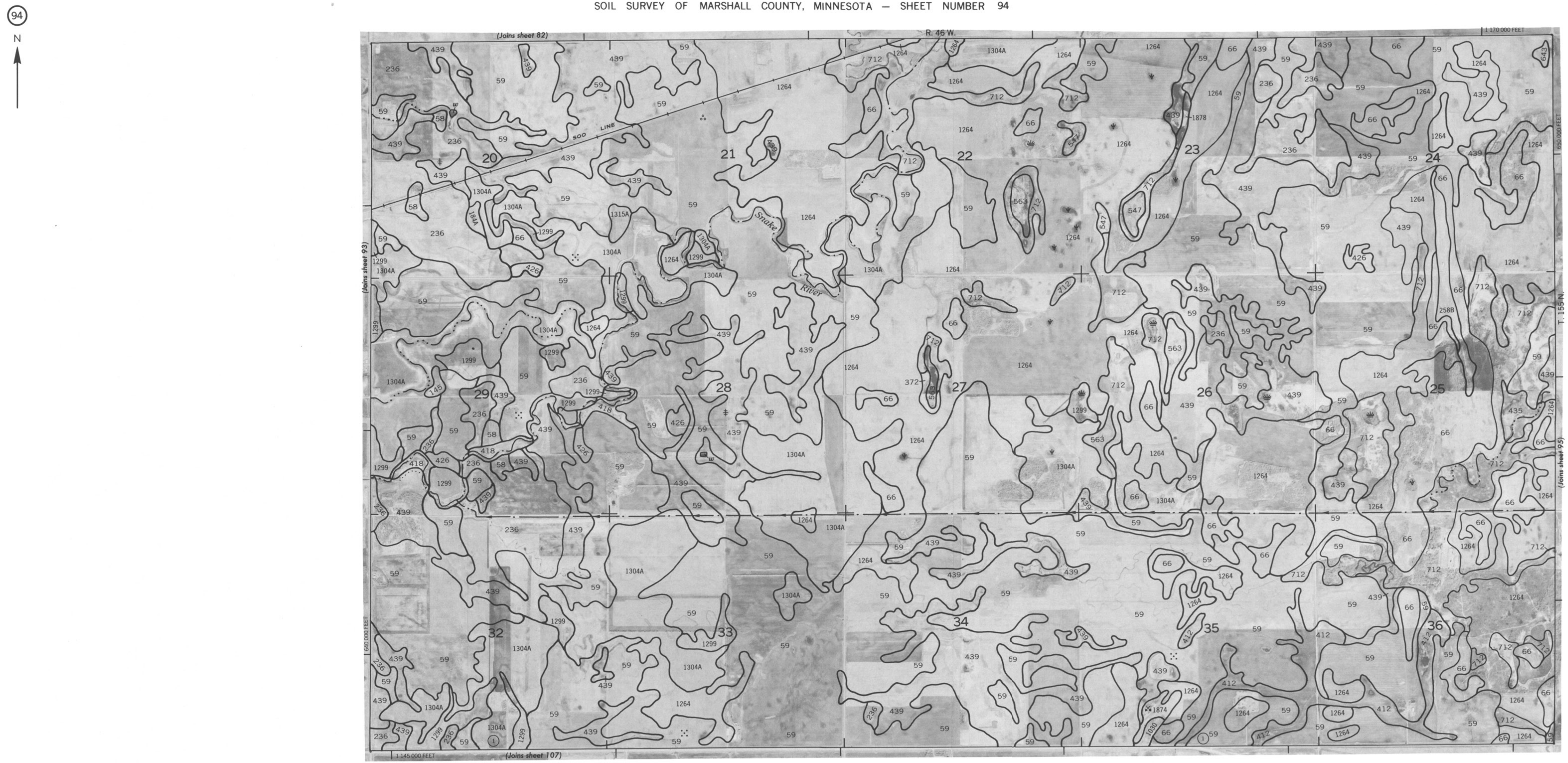


91
N
1 055 000 FEET
R. 49 W.
R. 48 W.
(Joins sheet 79)
(Joins sheet 92)
645 000 FEET
(Joins sheet 104)
1 080 000 FEET
(Joins sheet 90)
T. 155 N.
655 000 FEET
1964
1964
1964
1964
1963
1964
1964
57A
57A
57A
1963
20
1963
21
935
1964
22
935
935
23
1964
24
57A
57A
19
47
93A
1963
1964
1964
47
1964
935
935
935
1963
1963
1964
935
1963
1964
1963
1963
29
28
27
935
26
935
25
935
935
57A
30
1964
935
1964
67A
1963
935
57A
57A
1963
1963
1964
935
935
935
1964
57A
57A
57A
32
33
1963
34
1964
935
35
36
31
935
1963
935
1964
1964
1963
1963
935
935
57A
57A
①
①

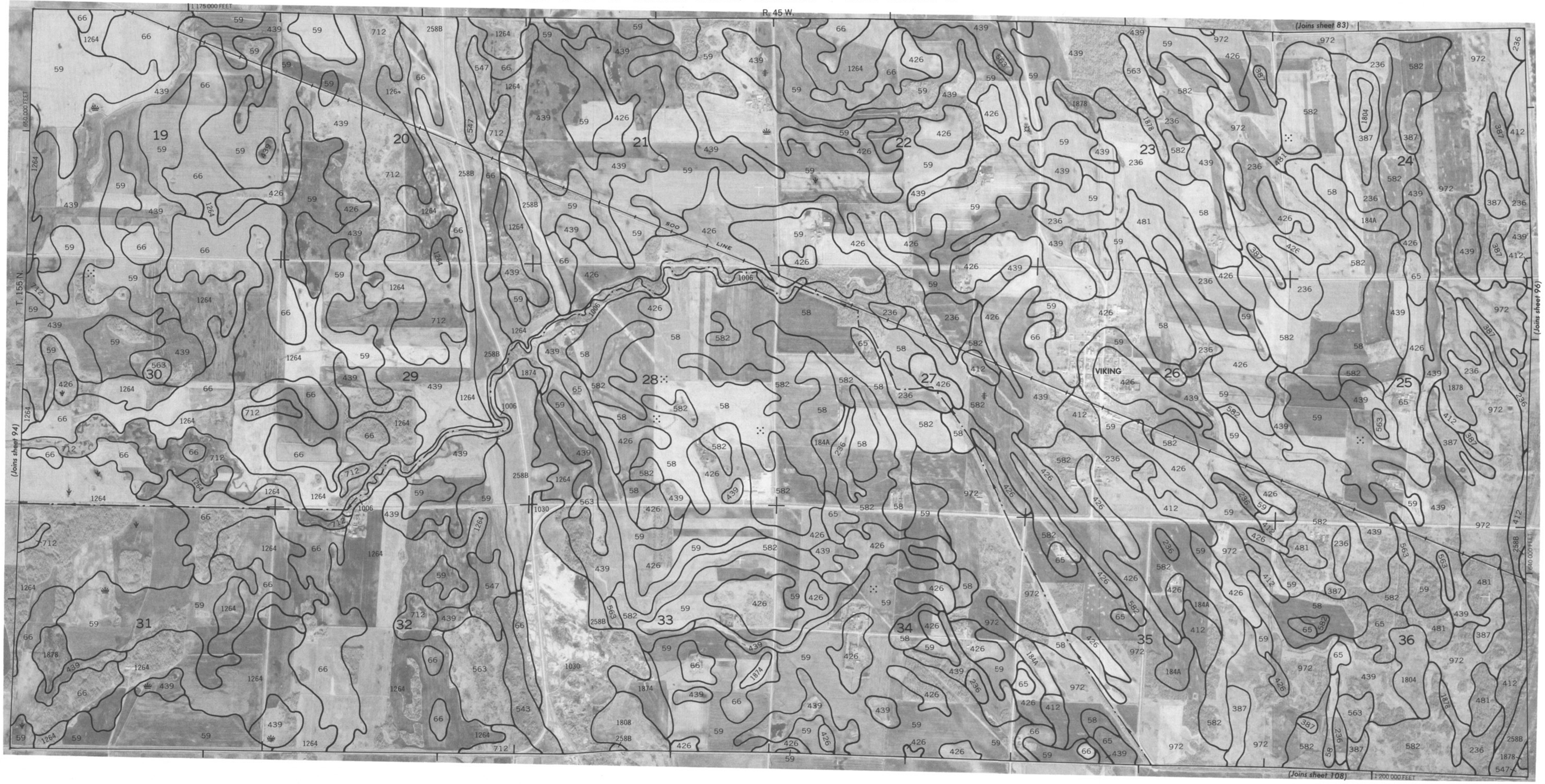

N
(Joins sheet 80)
(Joins sheet 91)
(Joins sheet 93)
(Joins sheet 105)
R. 48 W.
R. 47 W.
T. 155 N.
1 110 000 FEET
1 085 000 FEET
645 000 FEET
670 000 FEET
20
21
22
23
24
19
29
28
27
26
25
30
32
33
34
35
36
31
57A
47
67A
67B
93A
935
1964
1871
1315A
1299
1304A
1304B
643
642
236
481
1297
1006
1264
157A
SEWAGE LAGOON
BURLINGTON NORTHERN
Snake River
WARREN
75
SOO LINE
1


N
1 115 000 FEET
655 000 FEET
R. 47 W.
R. 46 W.
(Joins sheet 81)
(Joins sheet 92)
(Joins sheet 94)
(Joins sheet 106)
T. 155 N.
1 140 000 FEET
640 000 FEET
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
Snake River
SOO LINE

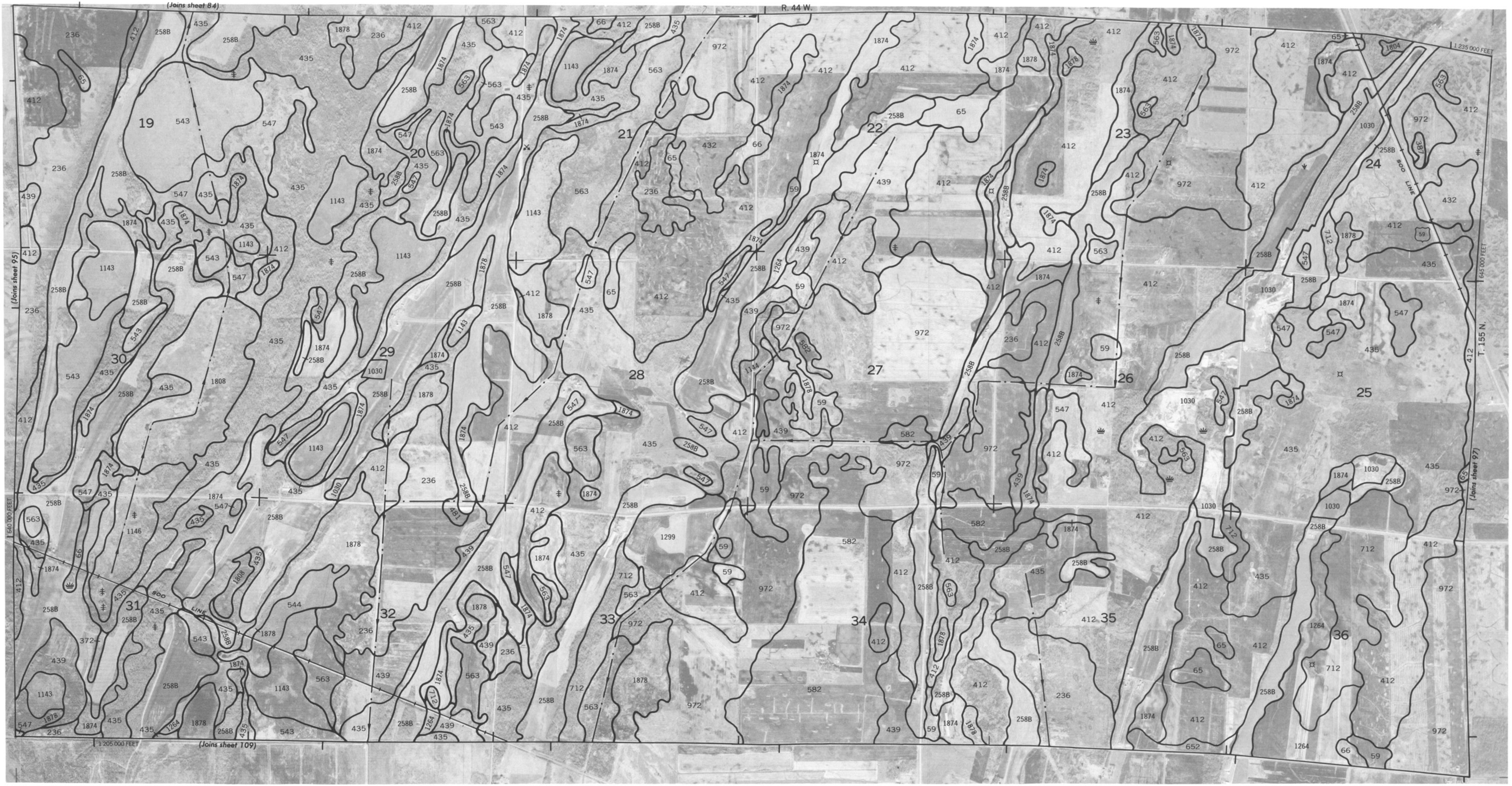
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 94


N
(Joins sheet 82)
R. 46 W.
1 170 000 FEET
550 000 FEET
T. 155 N.
(Joins sheet 95)
(Joins sheet 93)
640 000 FEET
1 145 000 FEET
(Joins sheet 107)
SOO LINE
Snake River
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 95


R. 45 W.
T. 155 N.
(Joins sheet 83)
(Joins sheet 94)
(Joins sheet 96)
(Joins sheet 108)
1 175 000 FEET
1 200 000 FEET
850 000 FEET
SOO LINE
VIKING
N

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 96


N
(Joins sheet 84)
R. 44 W.
1 235 000 FEET
(Joins sheet 95)
640 000 FEET
645 000 FEET
T. 155 N.
(Joins sheet 97)
1 205 000 FEET
(Joins sheet 109)
SOO LINE
19
20
21
22
23
24
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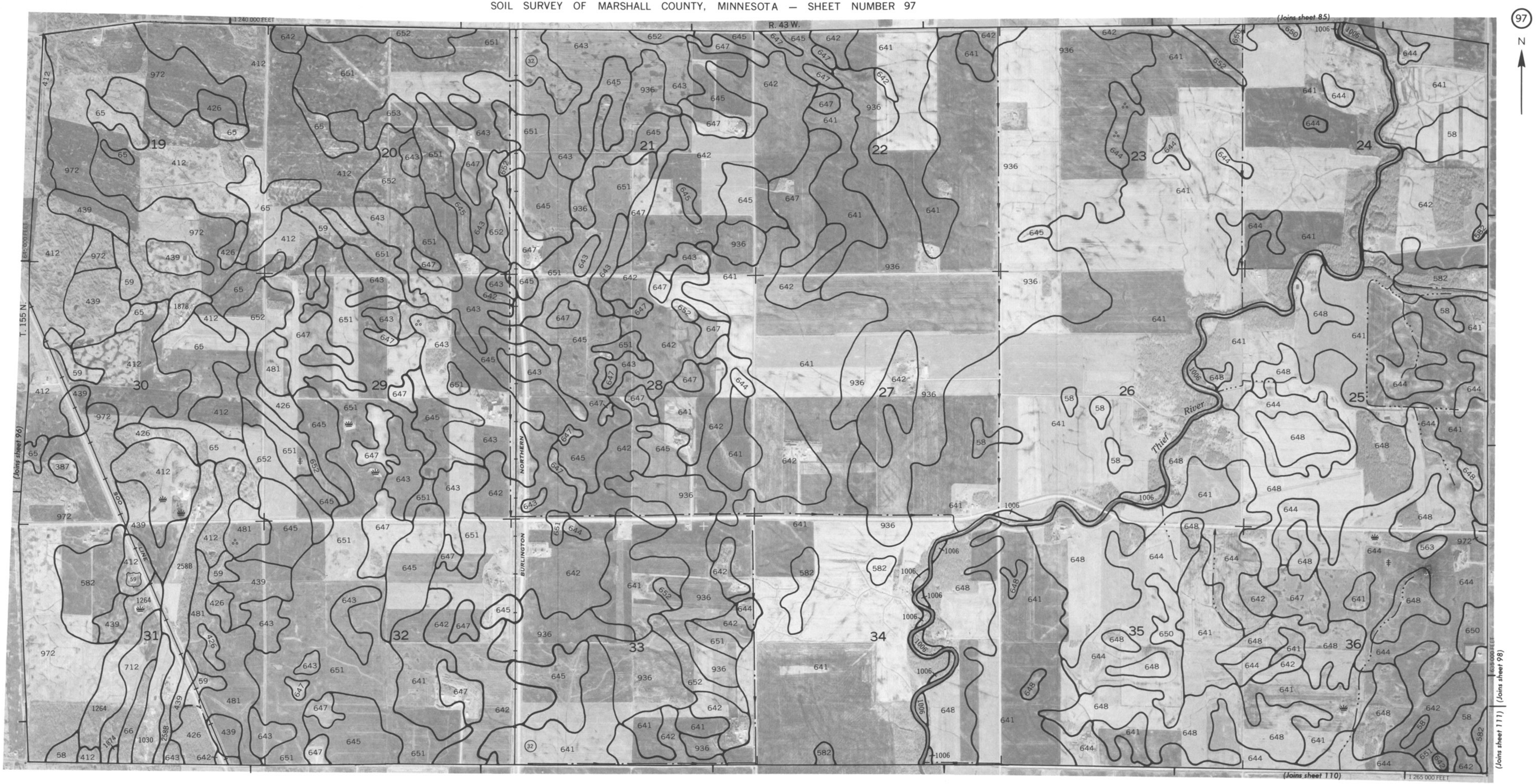
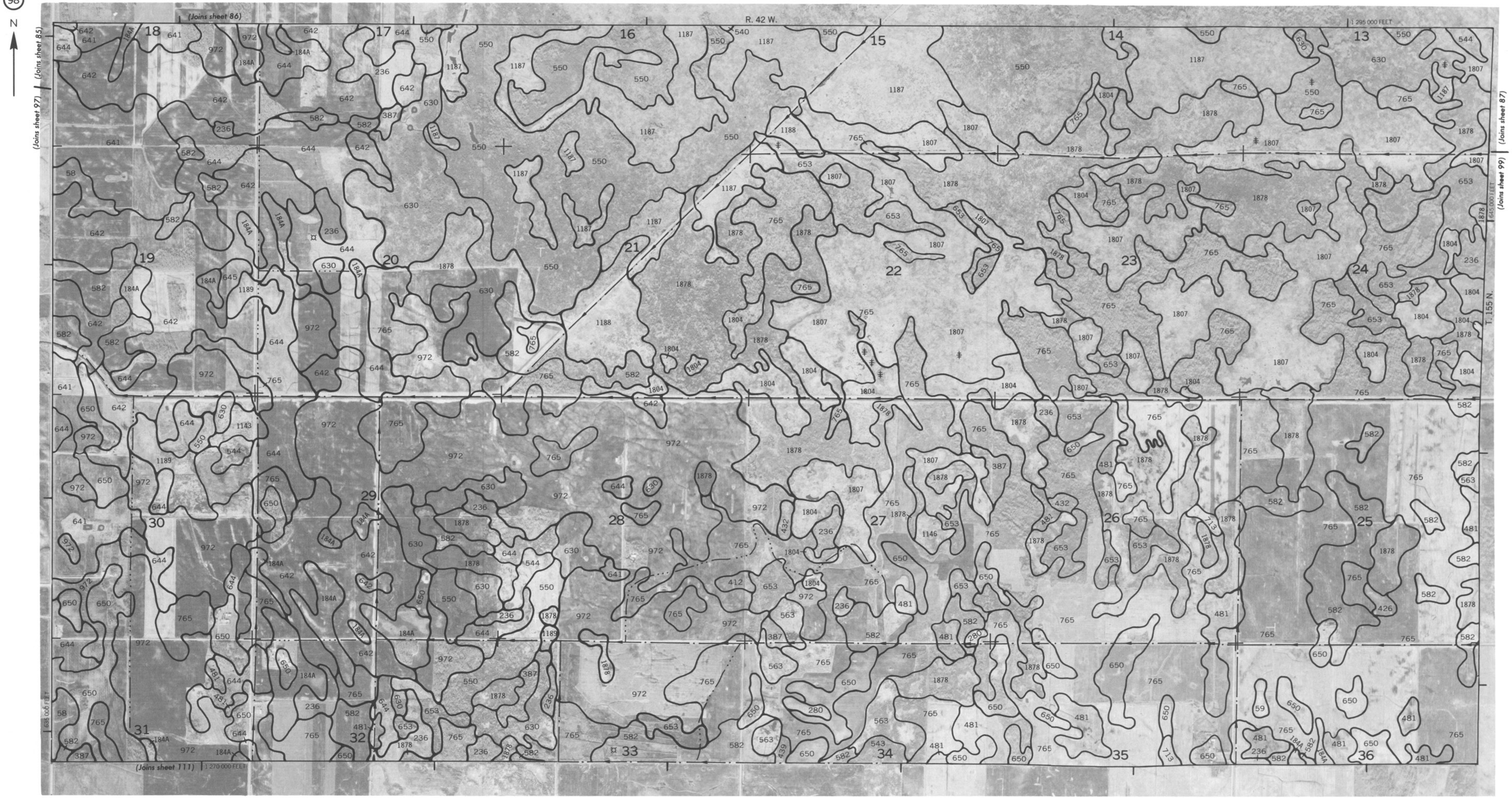
26
27
28
29
30
31
32
33
34
35
36

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 97


97
N
(Joins sheet 85)
(Joins sheet 96)
(Joins sheet 98)
(Joins sheet 111)
(Joins sheet 110)
1 240 000 FEET
1 265 000 FEET
645 000 FEET
635 000 FEET
R. 43 W.
T. 155 N.
NORTHERN
BURLINGTON
LINE
SOO
32
Thief
River
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 98


N
(Joins sheet 86)
R. 42 W.
1 295 000 FEET
(Joins sheet 85)
(Joins sheet 97)
(Joins sheet 87)
(Joins sheet 99)
645 000 FEET
T. 155 N.
635 000 FEET
(Joins sheet 111)
1 270 000 FEET
18
17
16
15
14
13
19
20
21
22
23
24
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29
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32
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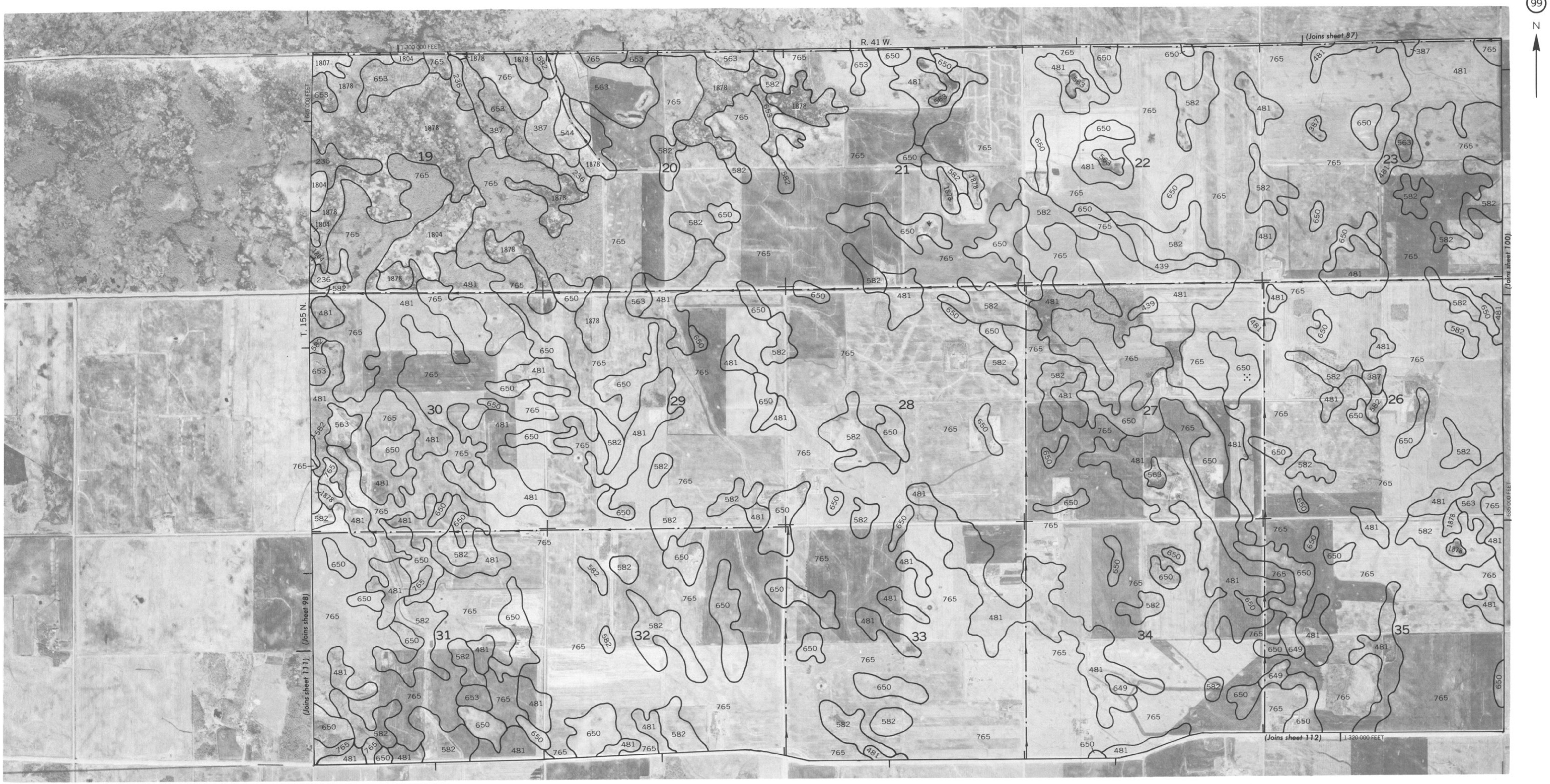
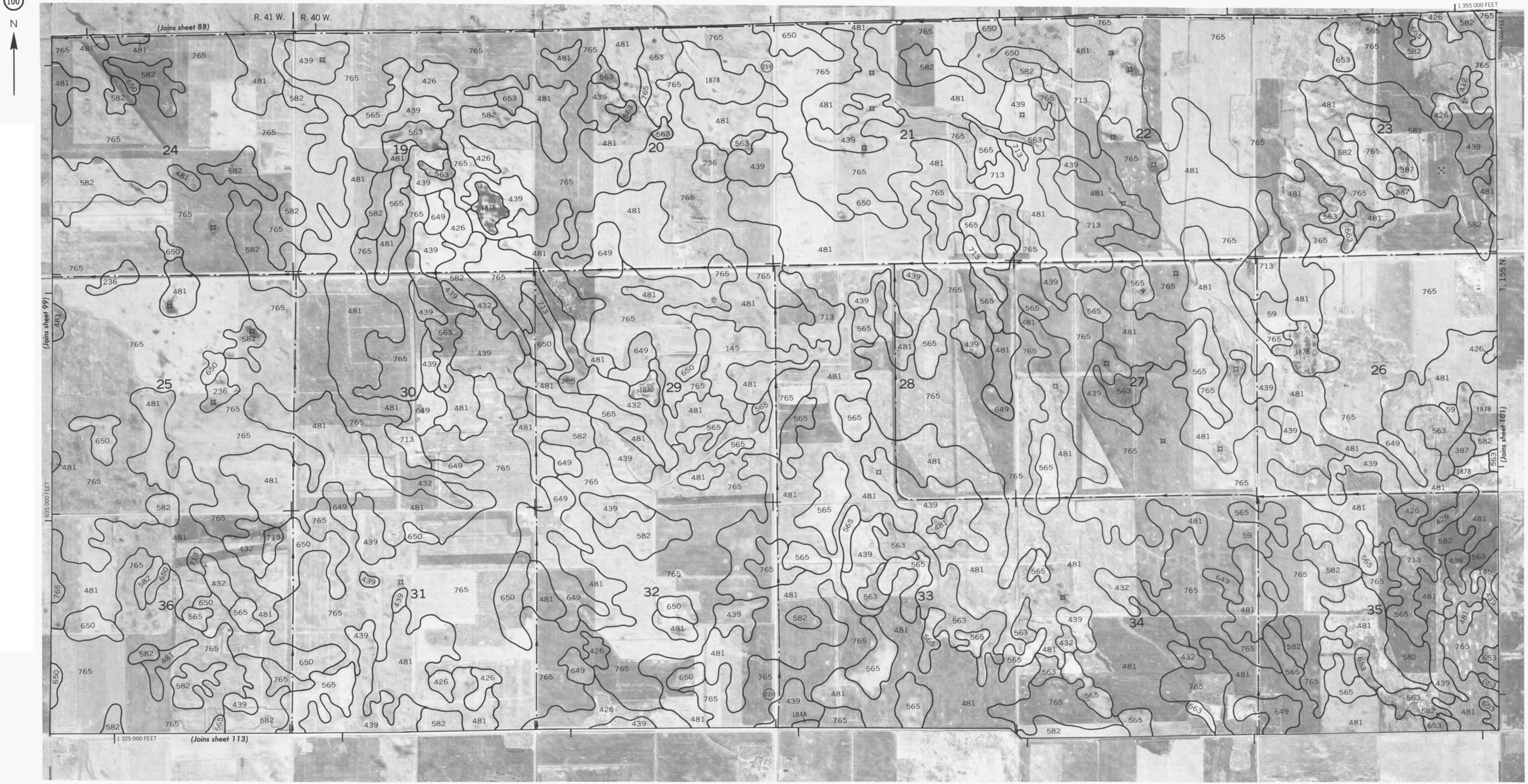
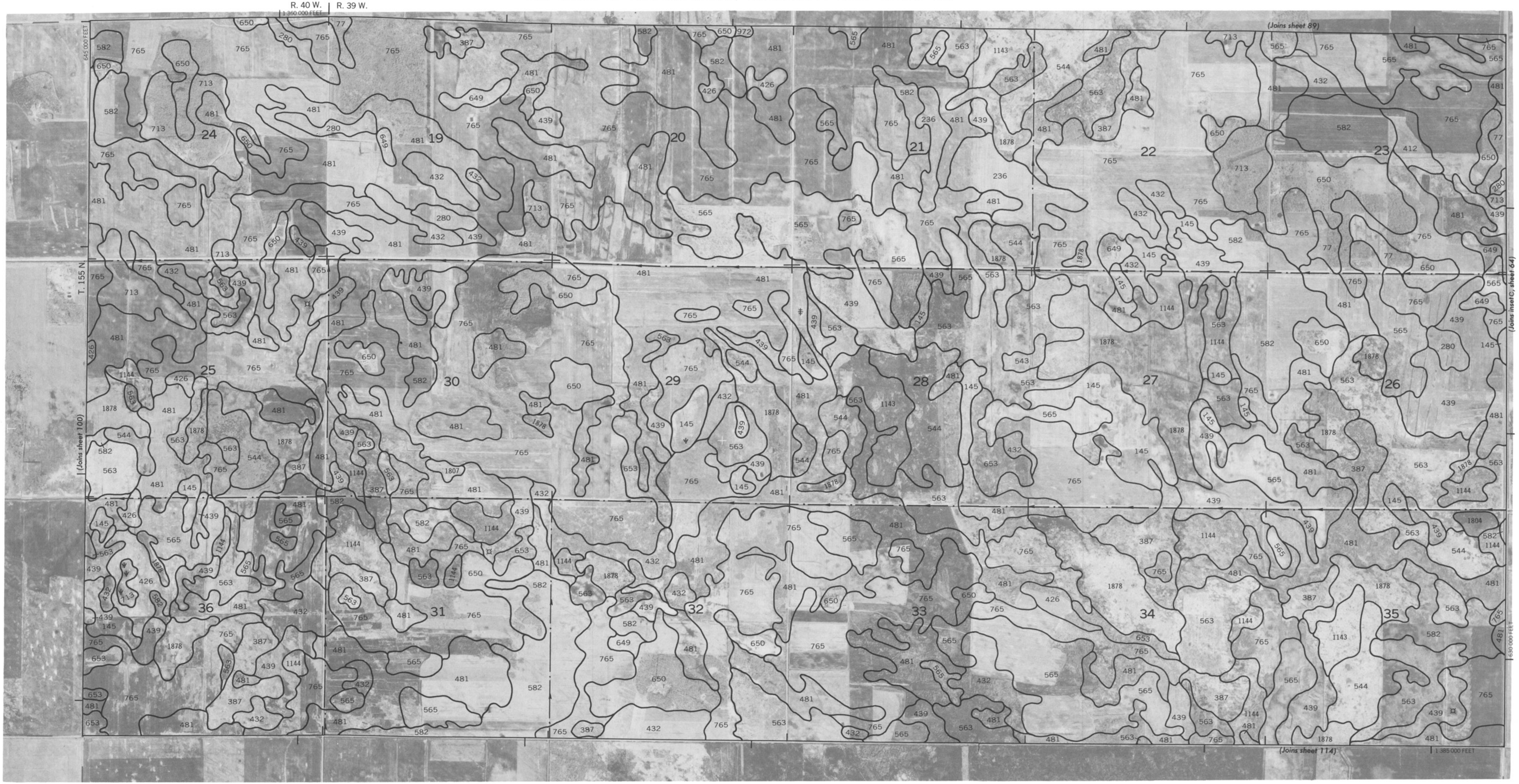
35
36


99
N
R. 41 W.
T. 155 N.
(Joins sheet 87)
(Joins sheet 100)
(Joins sheet 112)
(Joins sheet 98)
(Joins sheet 111)
1 300 000 FEET
1 320 000 FEET
640 000 FEET
635 000 FEET
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35

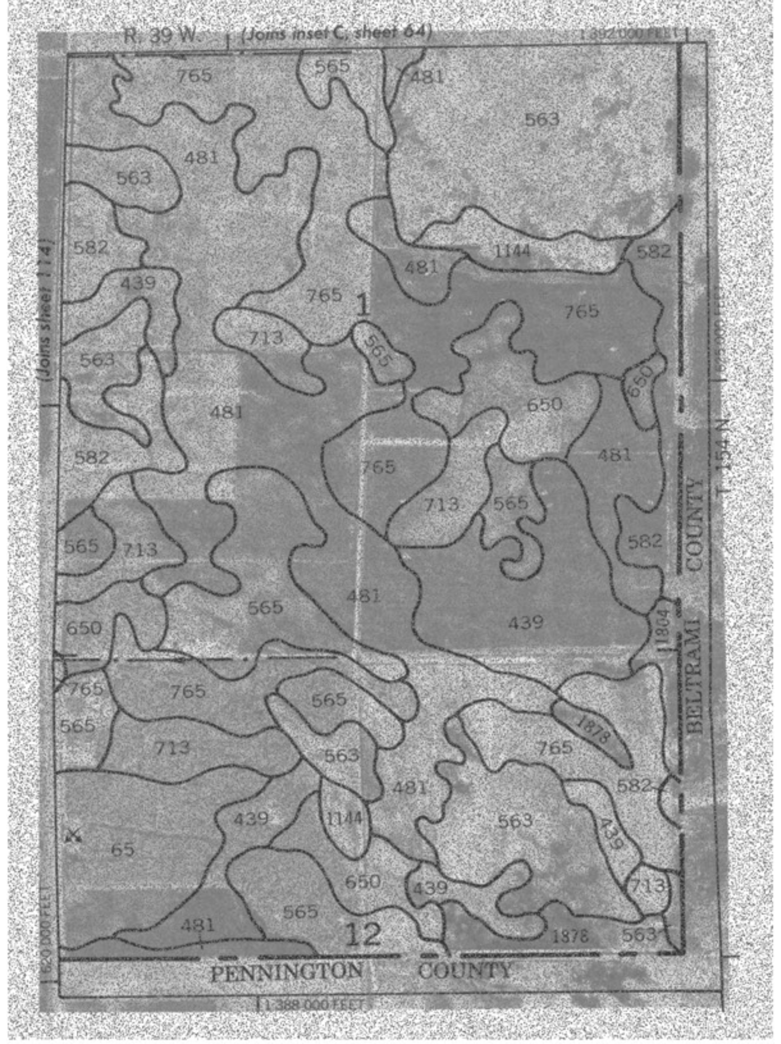
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 100

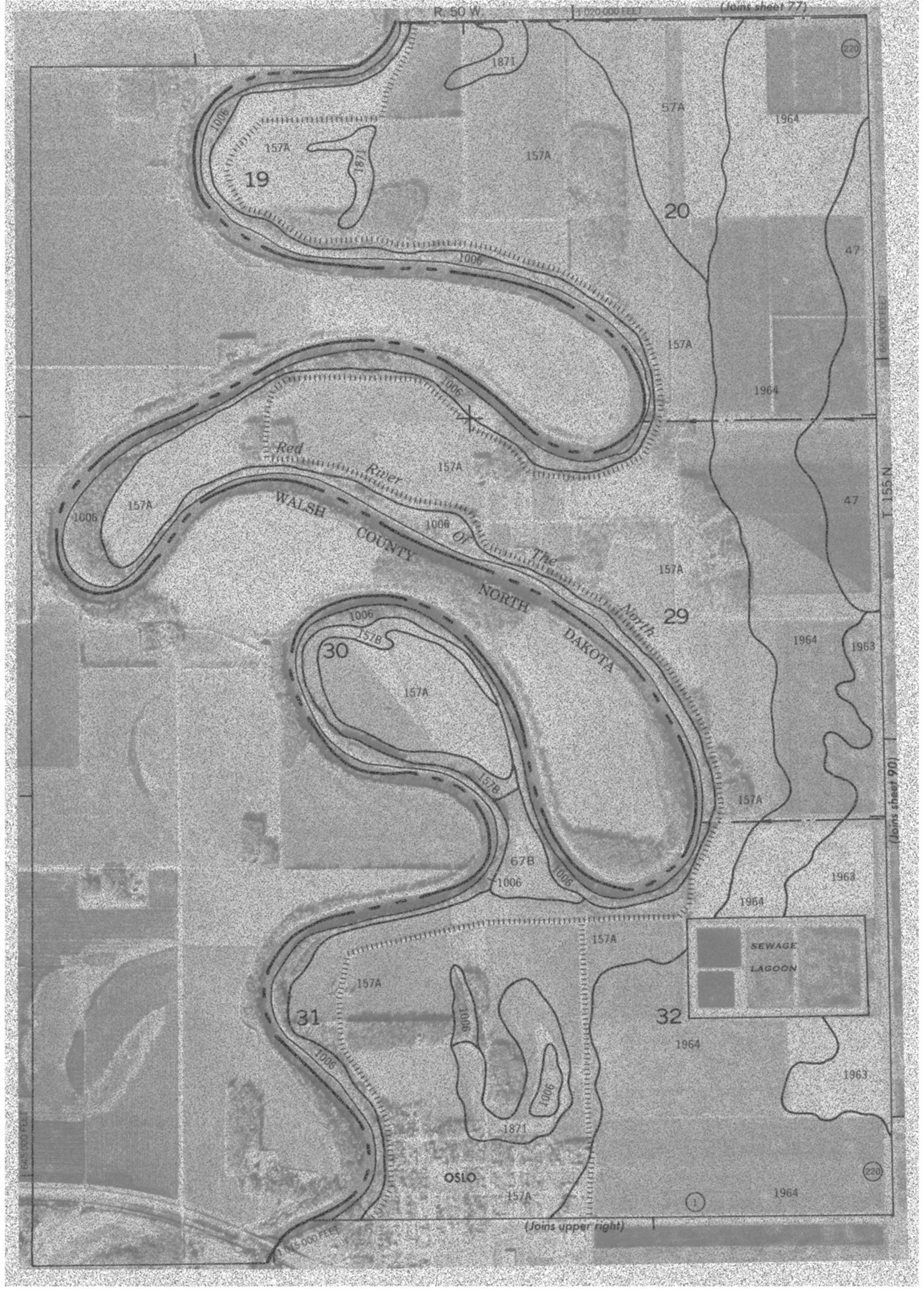

N
R. 41 W.
R. 40 W.
(Joins sheet 88)
1 355 000 FEET
645 000 FEET
T. 155 N.
(Joins sheet 101)
(Joins sheet 99)
635 000 FEET
1 325 000 FEET
(Joins sheet 113)
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

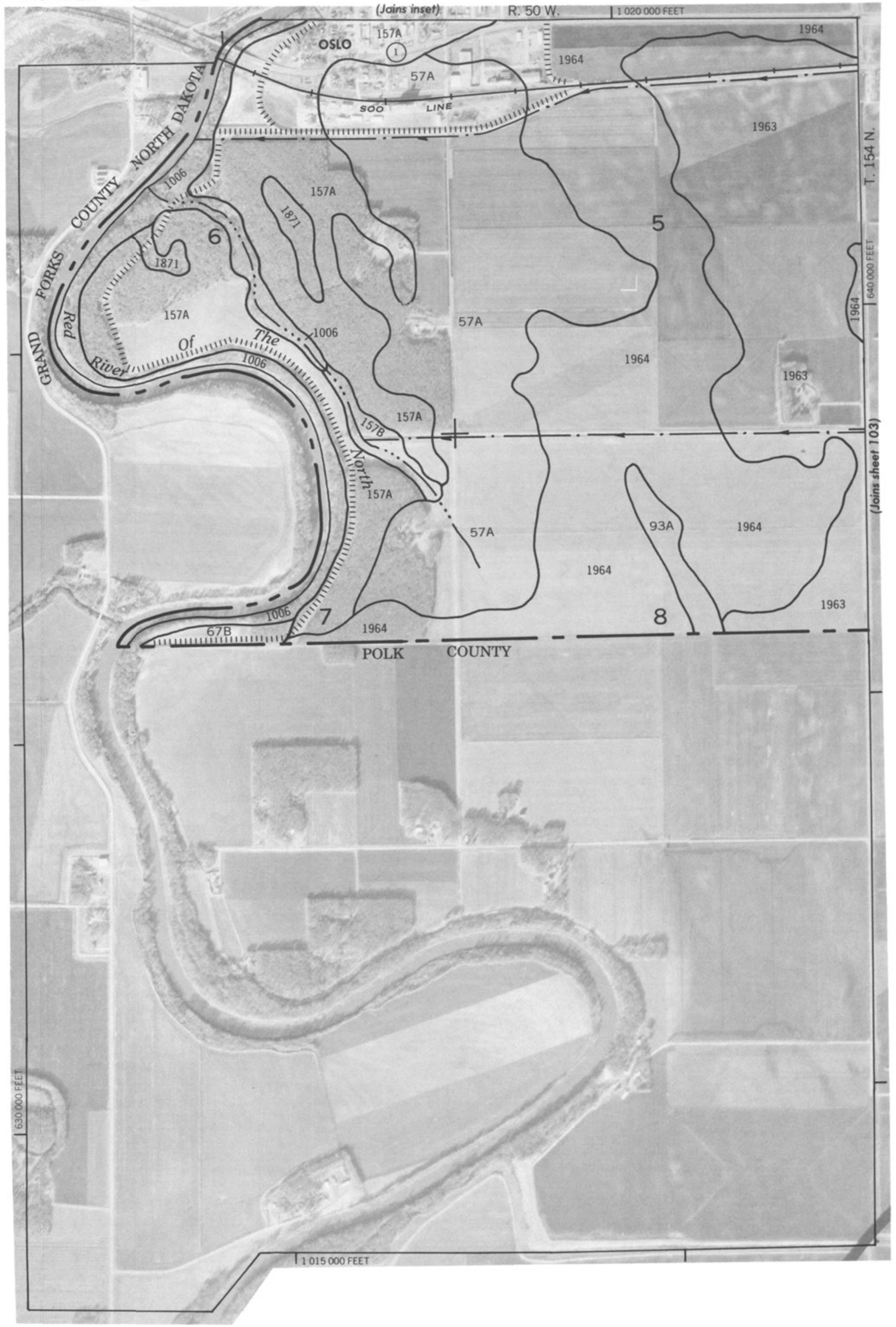
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 101


R. 40 W.
R. 39 W.
1 360 000 FEET
645 000 FEET
T. 155 N.
(Joins sheet 89)
(Joins inset C, sheet 64)
(Joins sheet 100)
(Joins sheet 114)
1 385 000 FEET
630 000 FEET
N
24
19
20
21
22
23
25
30
29
28
27
26
36
31
32
33
34
35

INSET B


N
R. 39 W.
(Joins inset C, sheet 64)
(Joins sheet 114)
T. 154 N.
BELTRAMI COUNTY
PENNINGTON COUNTY
1
12
765
565
481
563
582
439
713
650
1144
1804
1878
65

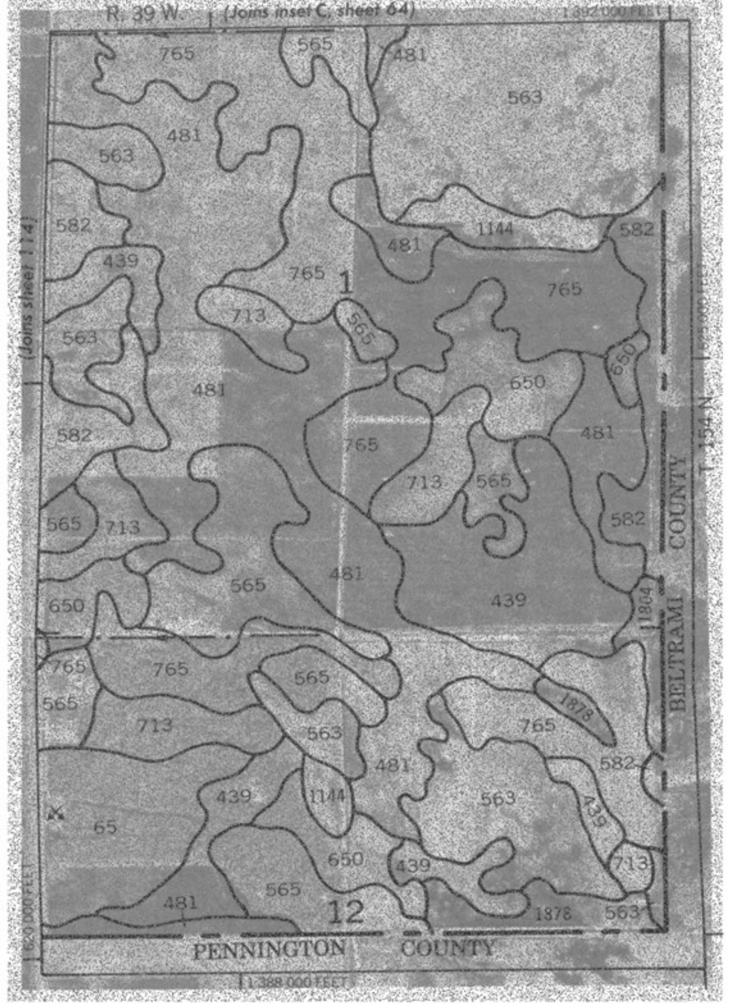

R. 50 W.
1 020 000 FEET
(Joins sheet 77)
(Joins sheet 90)
(Joins upper right)
T. 155 N.
Red River Of The North
WALSH COUNTY NORTH DAKOTA
OSLO
SEWAGE LAGOON
19
20
29
30
31
32
157A
57A
1871
1006
1964
1963
47
157B
67B
220
1

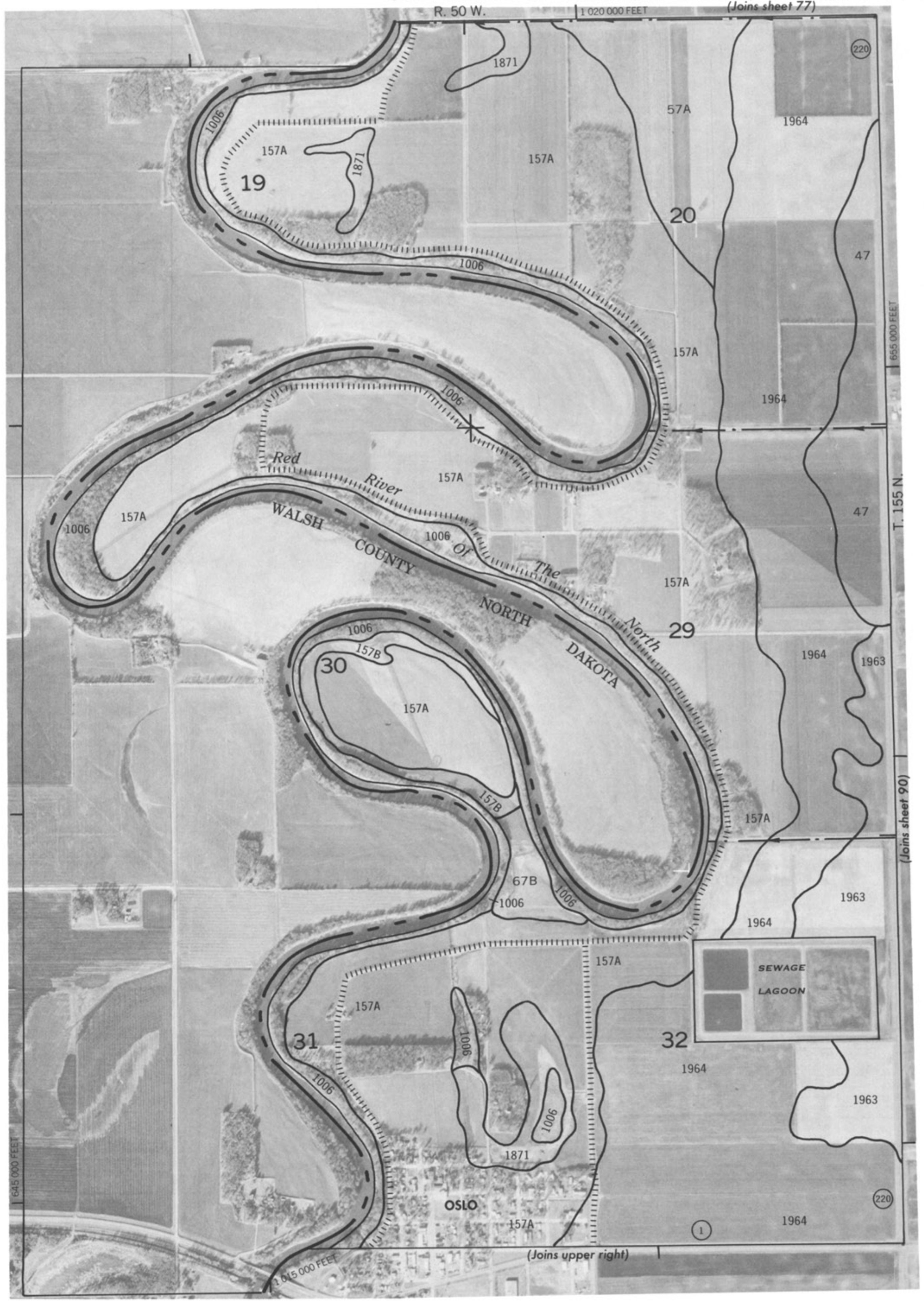

(Joins inset)
R. 50 W.
1 020 000 FEET
T. 154 N.
640 000 FEET
(Joins sheet 103)
630 000 FEET
1 015 000 FEET
OSLO
SOO LINE
GRAND FORKS COUNTY NORTH DAKOTA
Red River Of The North
POLK COUNTY
5
6
7
8
157A
57A
1871
1006
157B
67B
93A
1964
1963
1

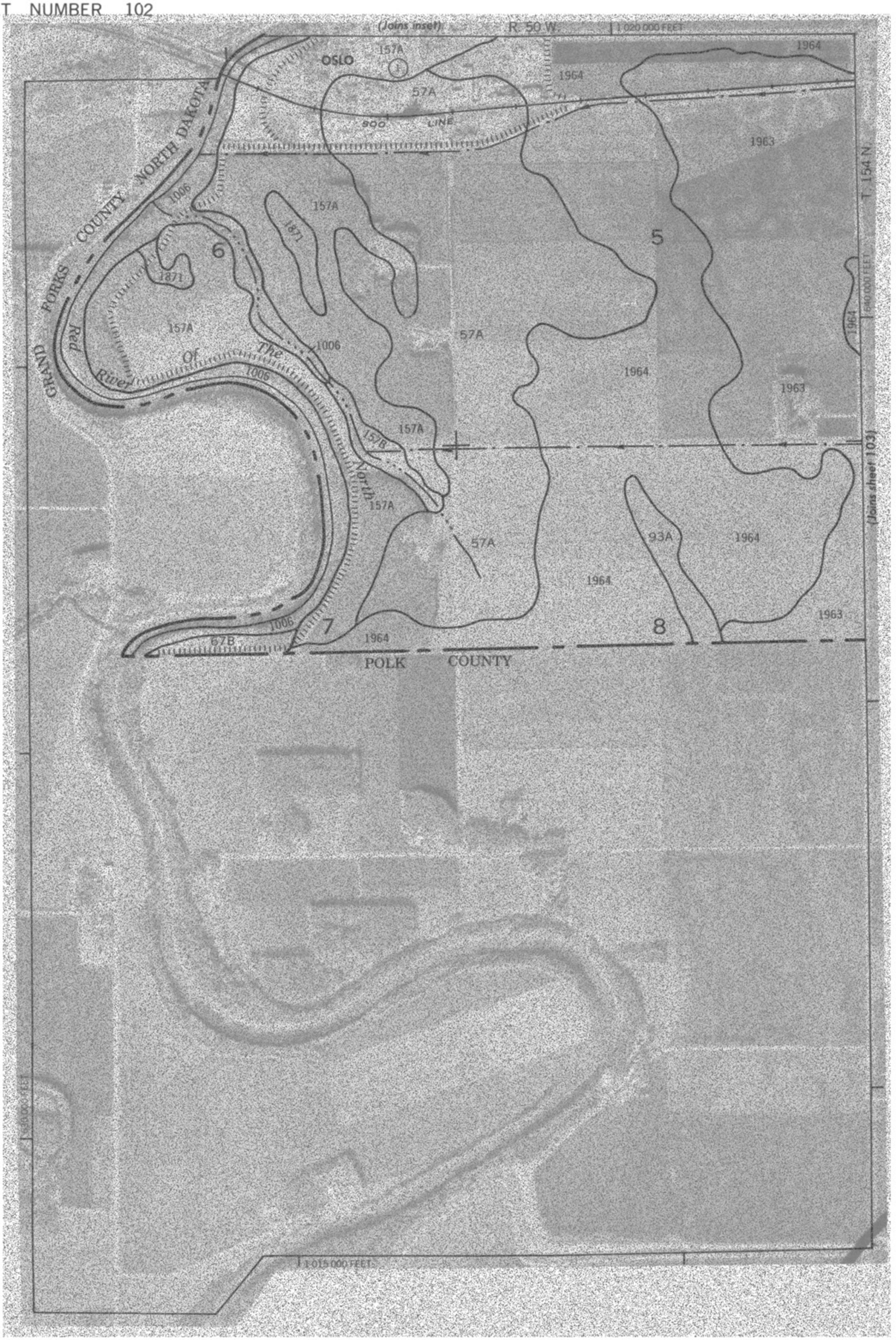
N

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 102

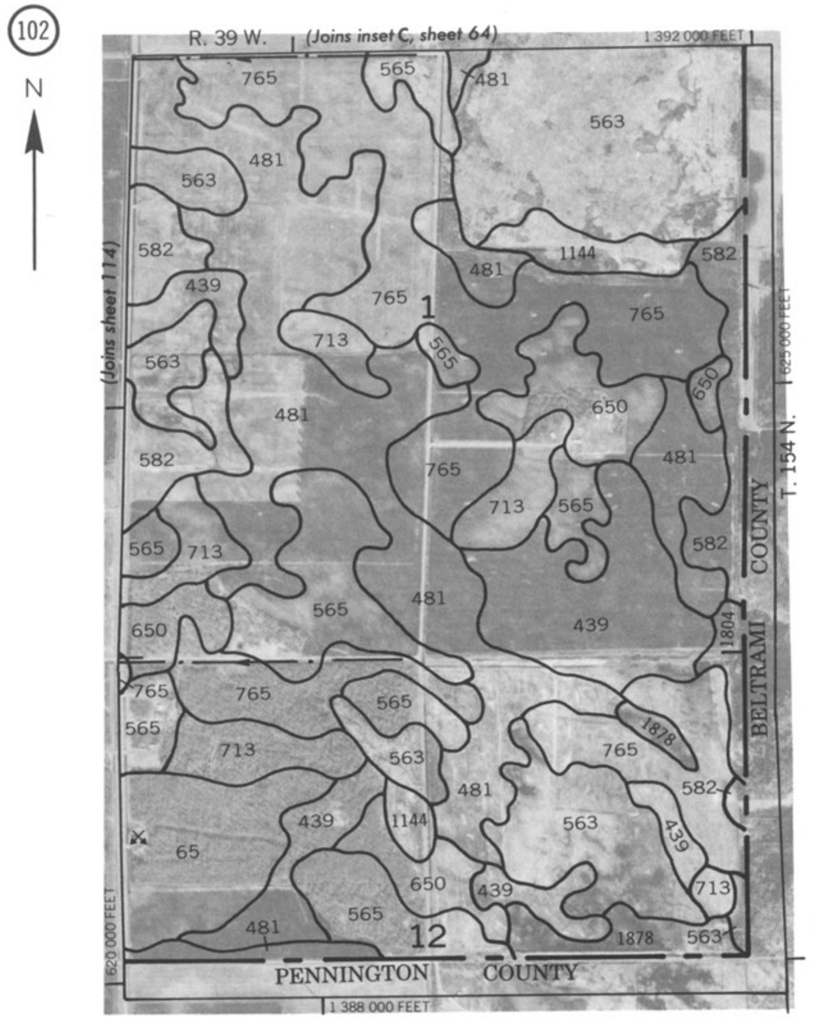
INSET B

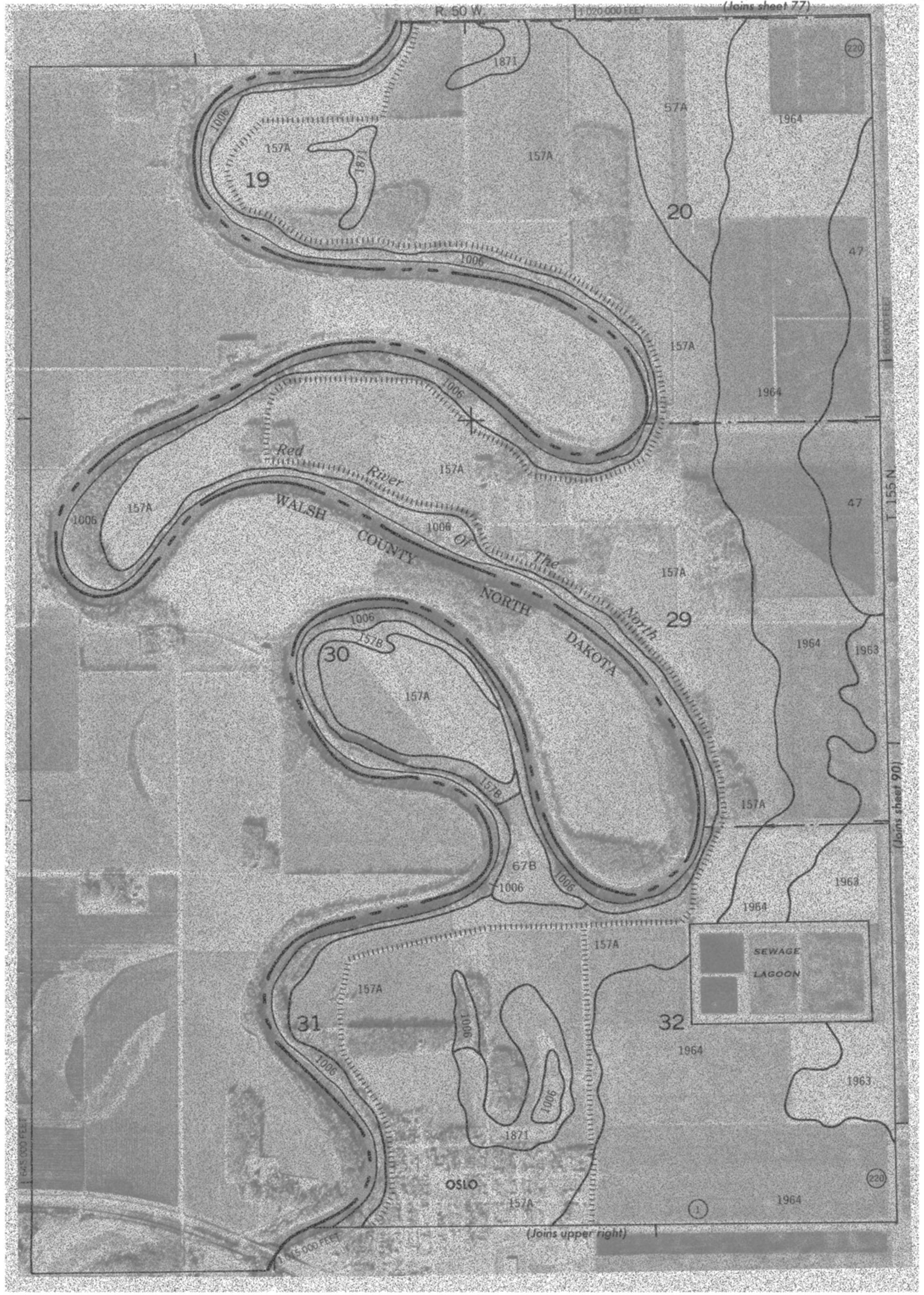

R. 39 W.
(Joins inset C, sheet 64)
1 382 000 FEET
(Joins sheet 114)
BELTRAMI COUNTY
154 N.
PENNINGTON COUNTY
1 388 000 FEET
1
12
765
565
481
563
582
439
713
650
1144
1878
1804
65

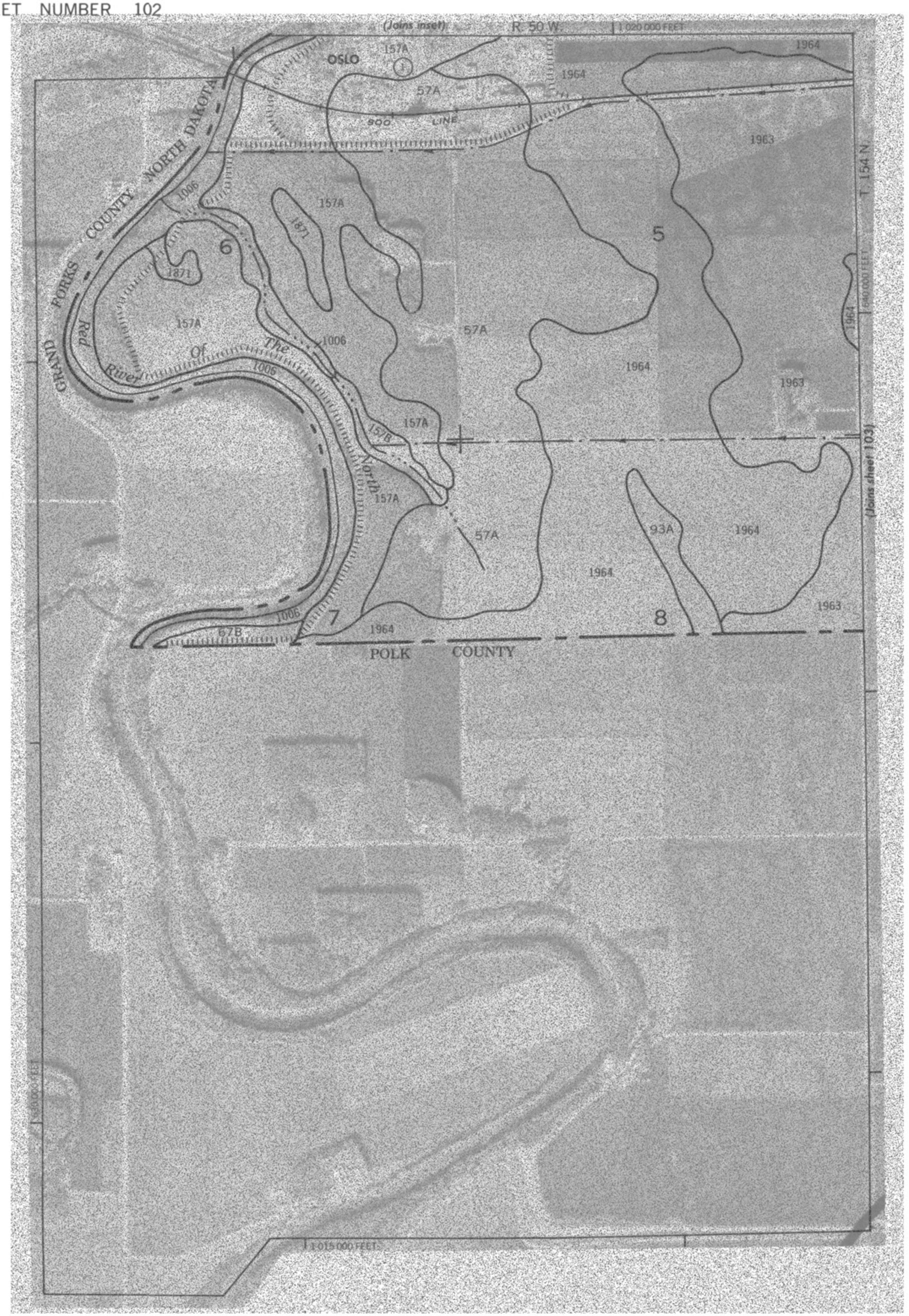

R. 50 W.
1 020 000 FEET
(Joins sheet 77)
(Joins sheet 90)
(Joins upper right)
T. 155 N.
655 000 FEET
645 000 FEET
1 015 000 FEET
220
1
Red River Of The North
WALSH COUNTY NORTH DAKOTA
SEWAGE LAGOON
OSLO
19
20
29
30
31
32
1871
157A
157B
57A
1964
1963
1006
47
67B


(Joins inset)
R. 50 W.
1 020 000 FEET
T. 154 N.
(Joins sheet 103)
OSLO
1
SOO LINE
GRAND FORKS COUNTY NORTH DAKOTA
Red River Of The North
POLK COUNTY
1 015 000 FEET
5
6
7
8
157A
57A
1964
1963
1006
1871
157B
93A
67B

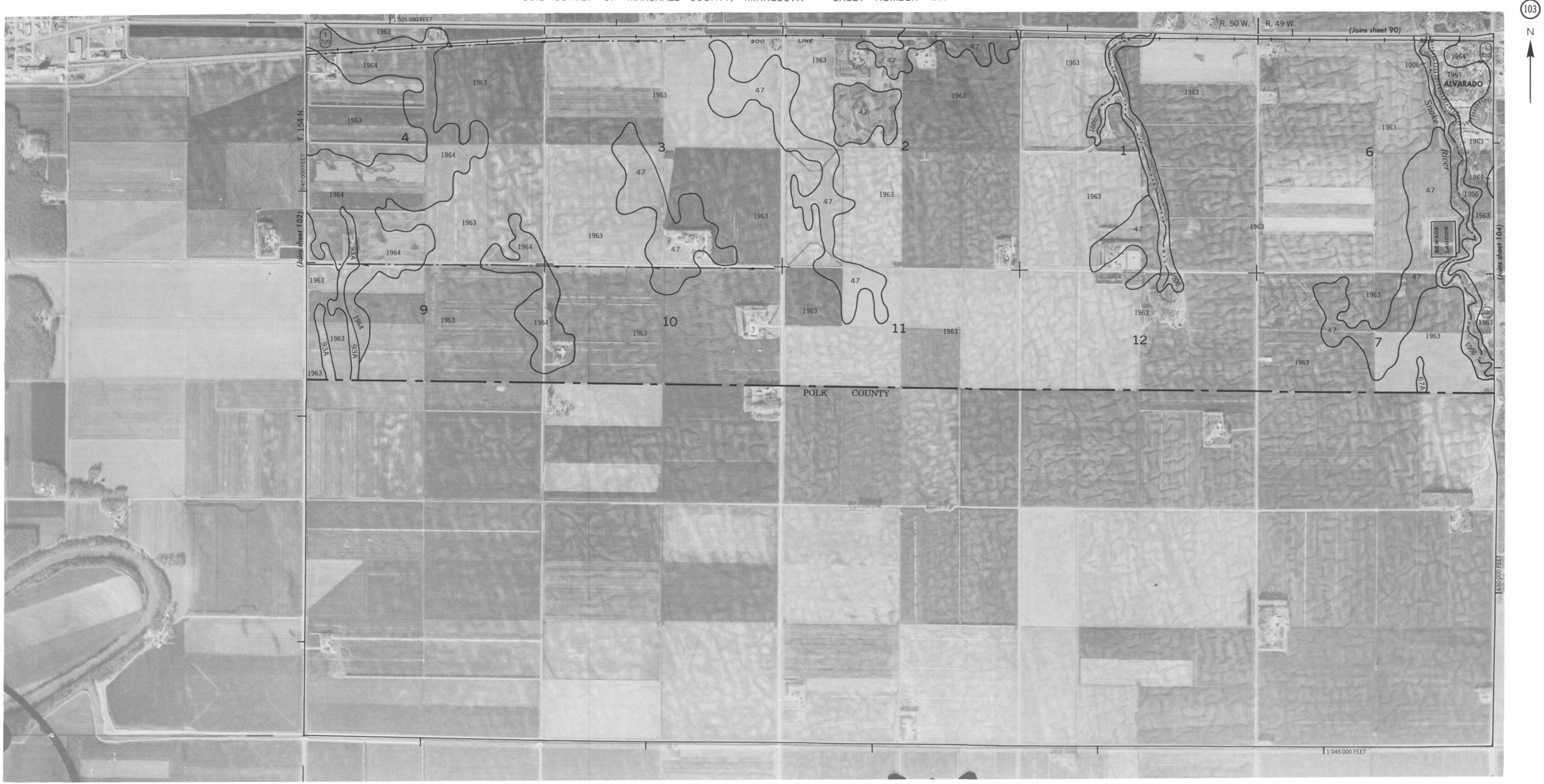
INSET B


102
N
R. 39 W.
(Joins inset C, sheet 64)
1 392 000 FEET
(Joins sheet 114)
T. 154 N.
BELTRAMI COUNTY
PENNINGTON COUNTY
1 388 000 FEET
1
12
765
565
481
563
1144
582
439
713
650
1804
1878
65


R. 50 W.
1 020 000 FEET
(Joins sheet 77)
(Joins sheet 90)
(Joins upper right)
T. 155 N.
19
20
29
30
31
32
Red River Of The North
WALSH COUNTY NORTH DAKOTA
SEWAGE LAGOON
OSLO
157A
57A
1871
1006
1964
1963
47
157B
67B
220
1

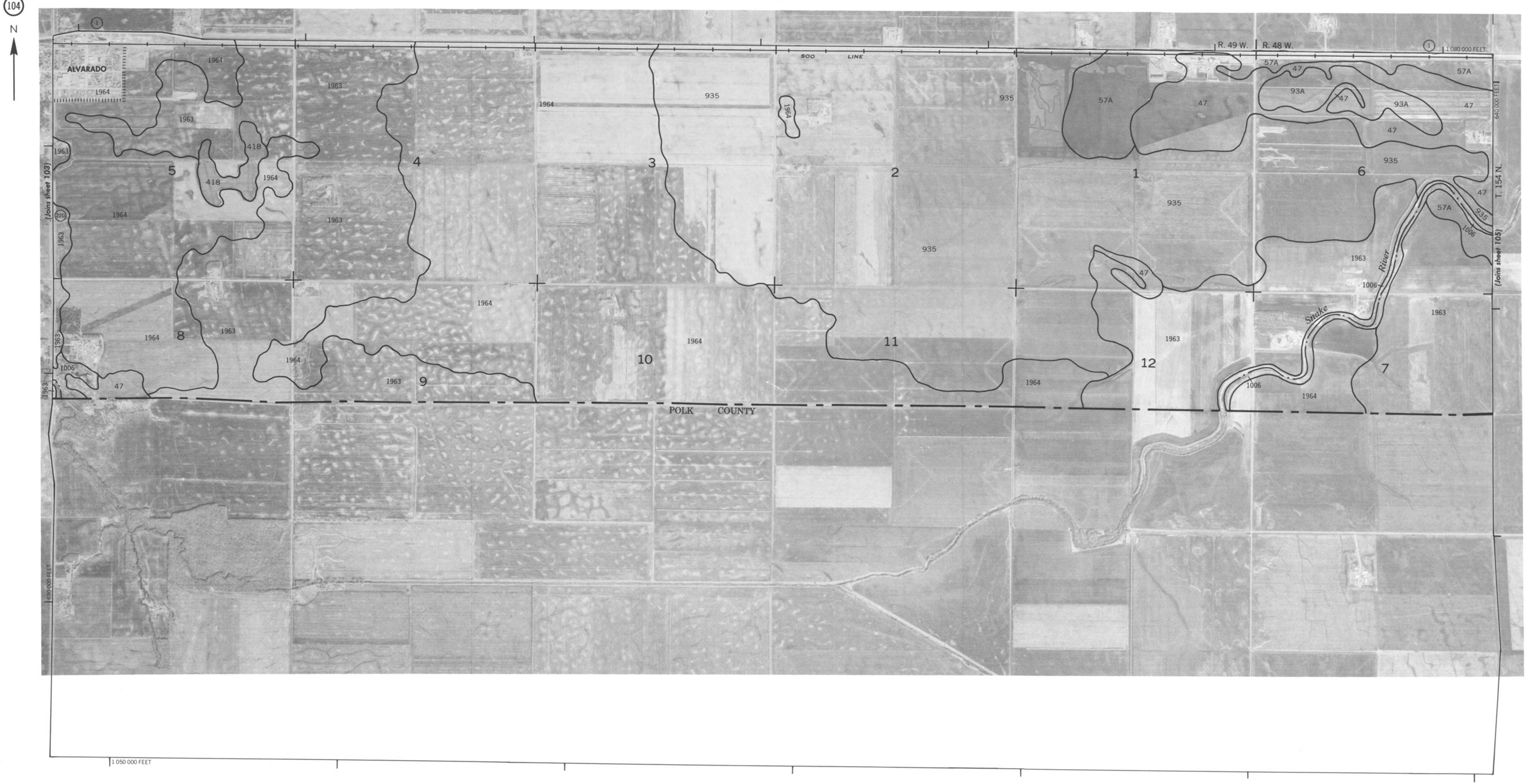

(Joins inset)
R. 50 W.
1 020 000 FEET
OSLO
SOO LINE
T. 154 N.
(Joins sheet 103)
GRAND FORKS COUNTY NORTH DAKOTA
Red River Of The North
POLK COUNTY
1 015 000 FEET
5
6
7
8
157A
57A
1871
1006
1964
1963
157B
67B
93A
1

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 103

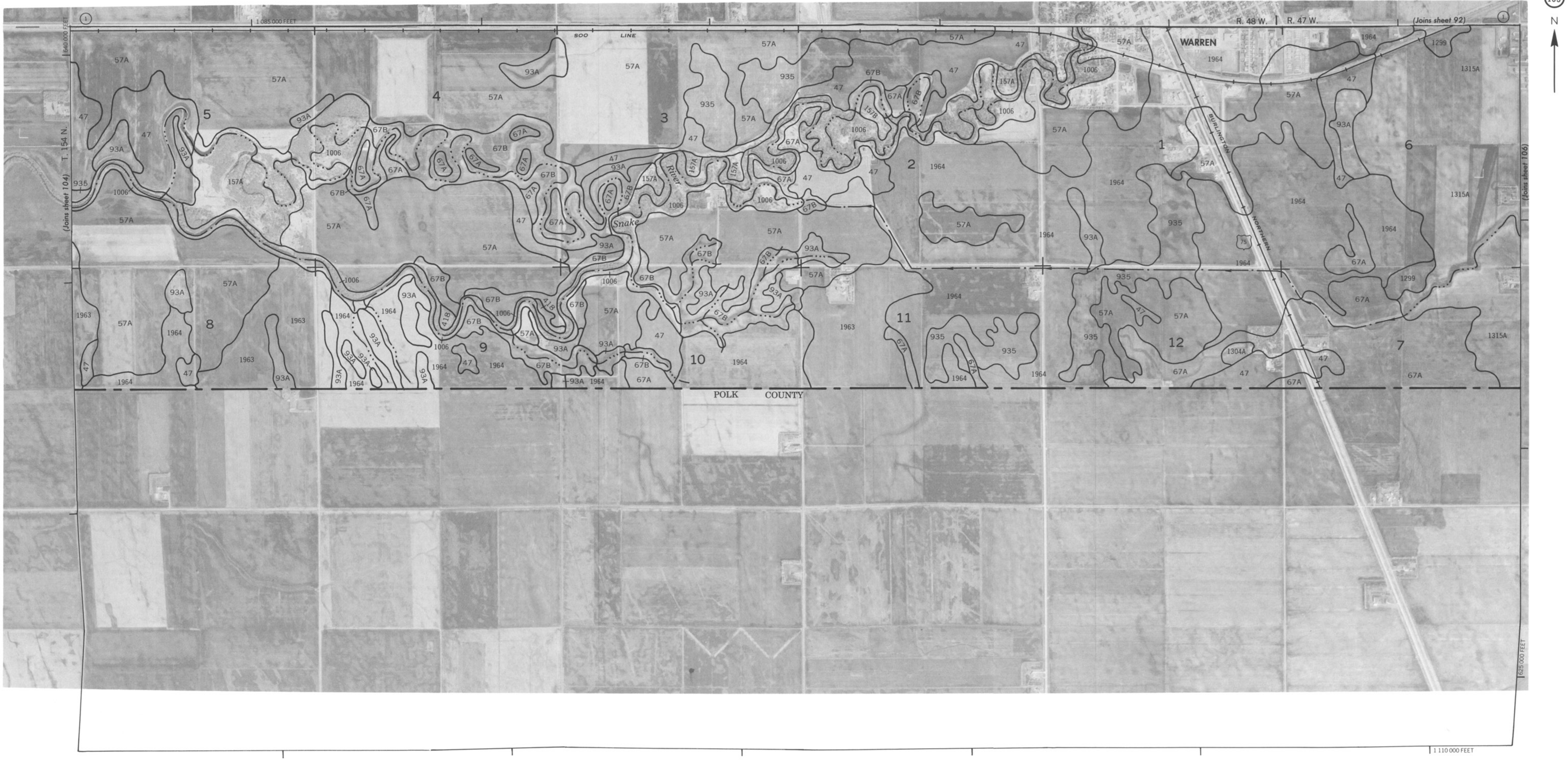


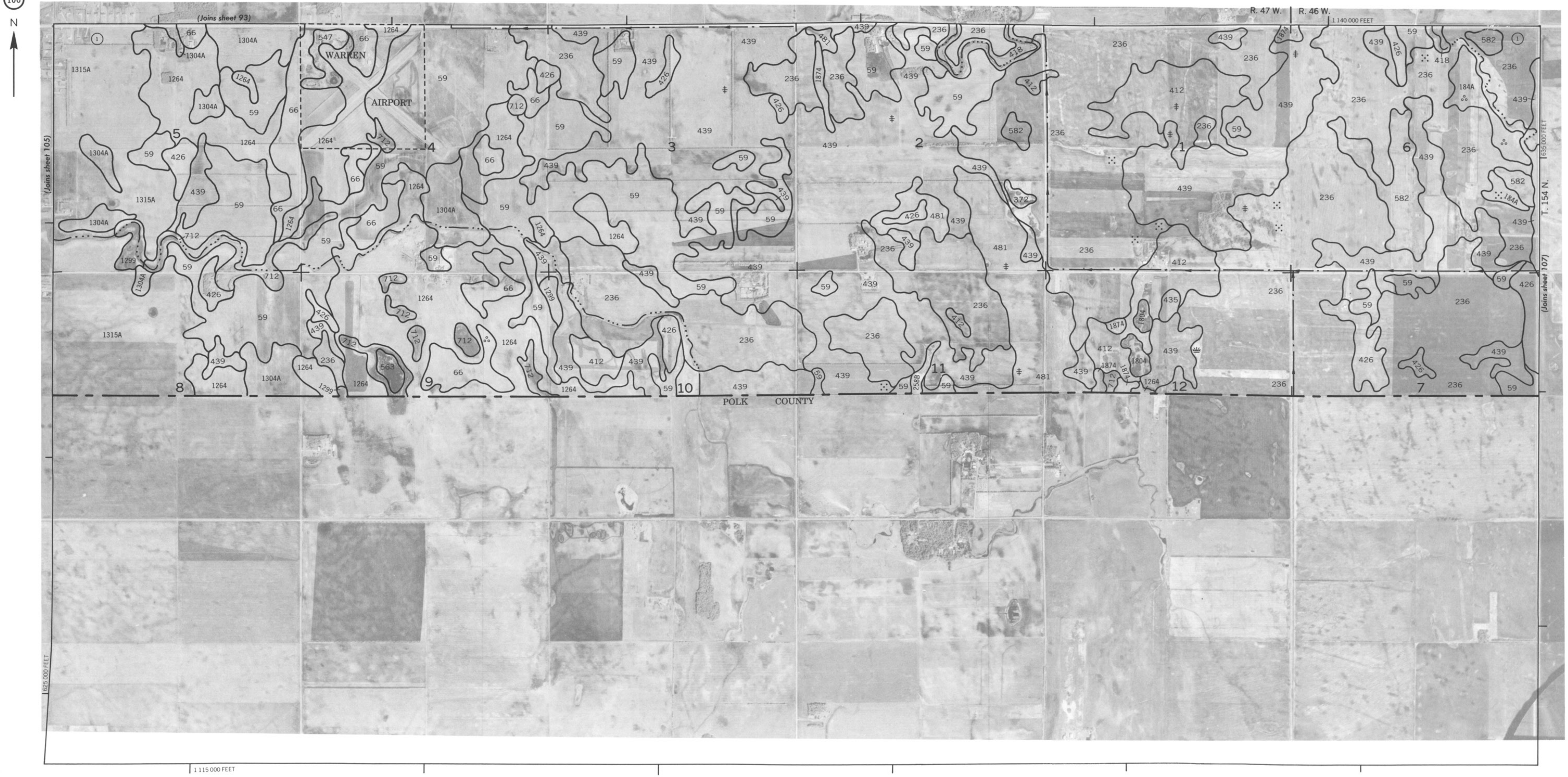
103
N
1 025 000 FEET
R. 50 W.
R. 49 W.
(Joins sheet 90)
SOO LINE
T. 154 N.
640 000 FEET
(Joins sheet 102)
(Joins sheet 104)
630 000 FEET
1 045 000 FEET
ALVARADO
Snake River
SEWAGE LAGOON
POLK COUNTY
1
2
3
4
6
7
9
10
11
12
220
47
93A
67A
1006
1963
1964

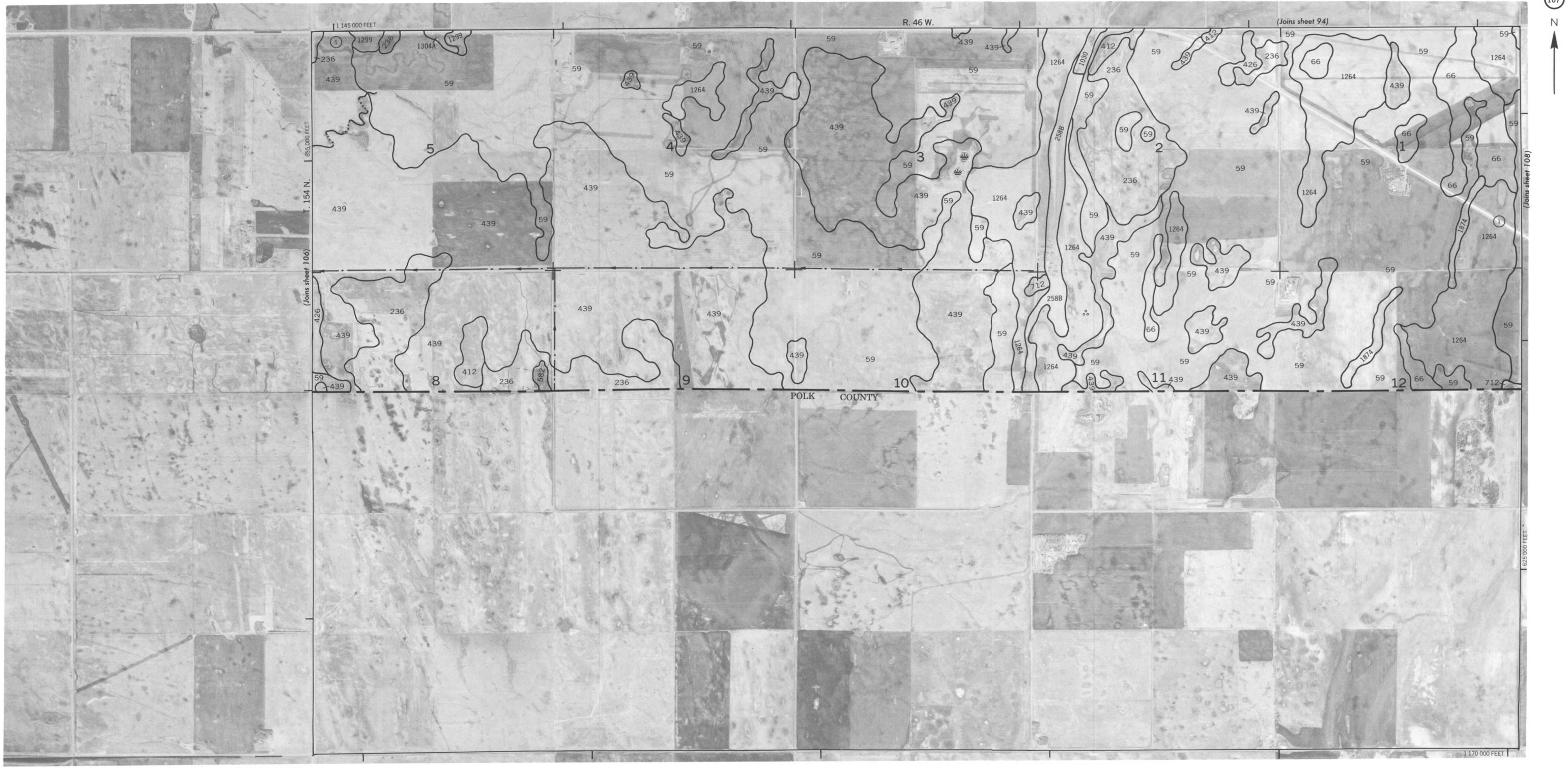
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 104


104
N
ALVARADO
SOO LINE
R. 49 W.
R. 48 W.
T. 154 N.
1 080 000 FEET
640 000 FEET
630 000 FEET
1 050 000 FEET
(Joins sheet 103)
(Joins sheet 105)
1
220
POLK COUNTY
Snake River
1
2
3
4
5
6
7
8
9
10
11
12
1963
1964
935
418
47
57A
93A
1006

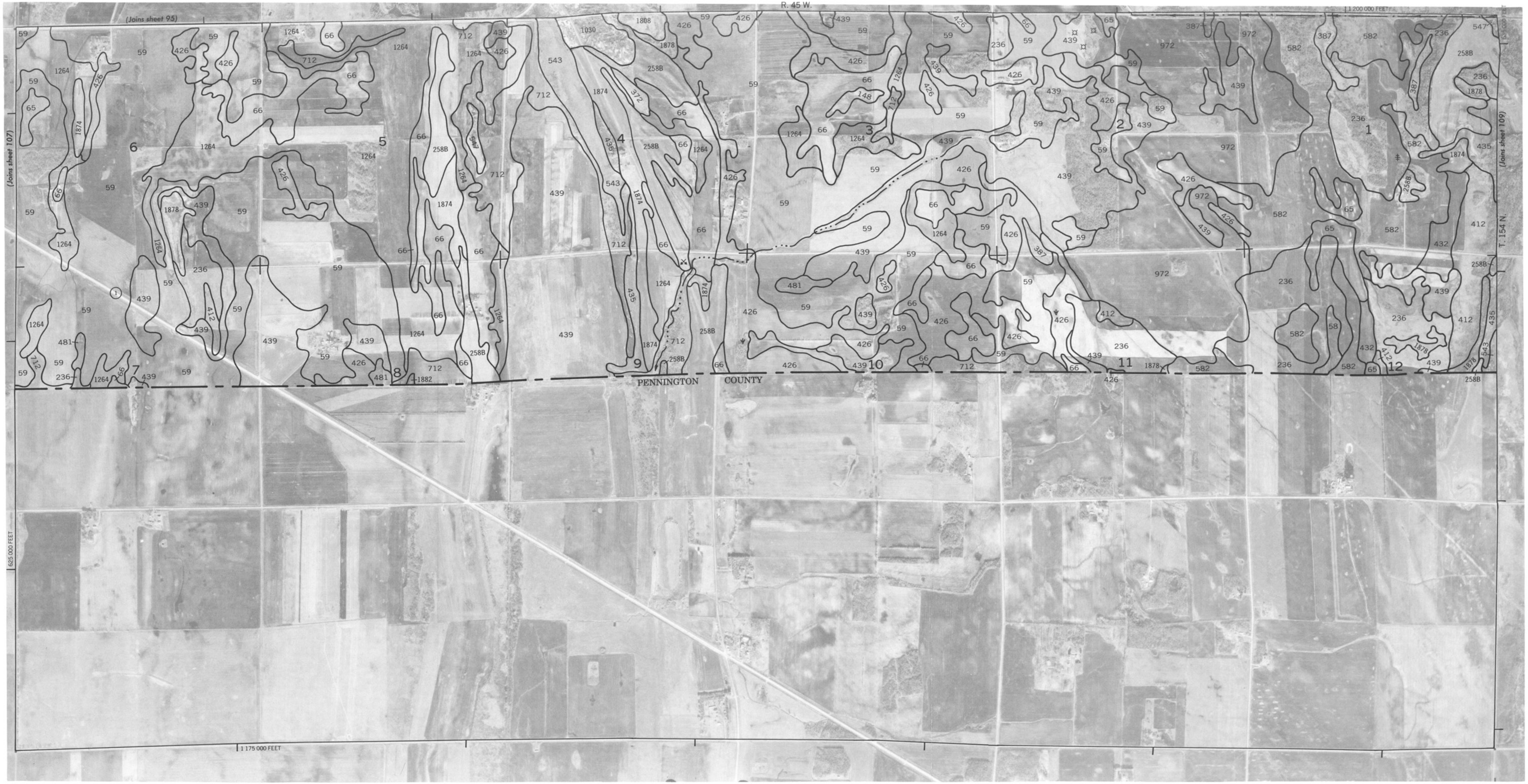
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 105

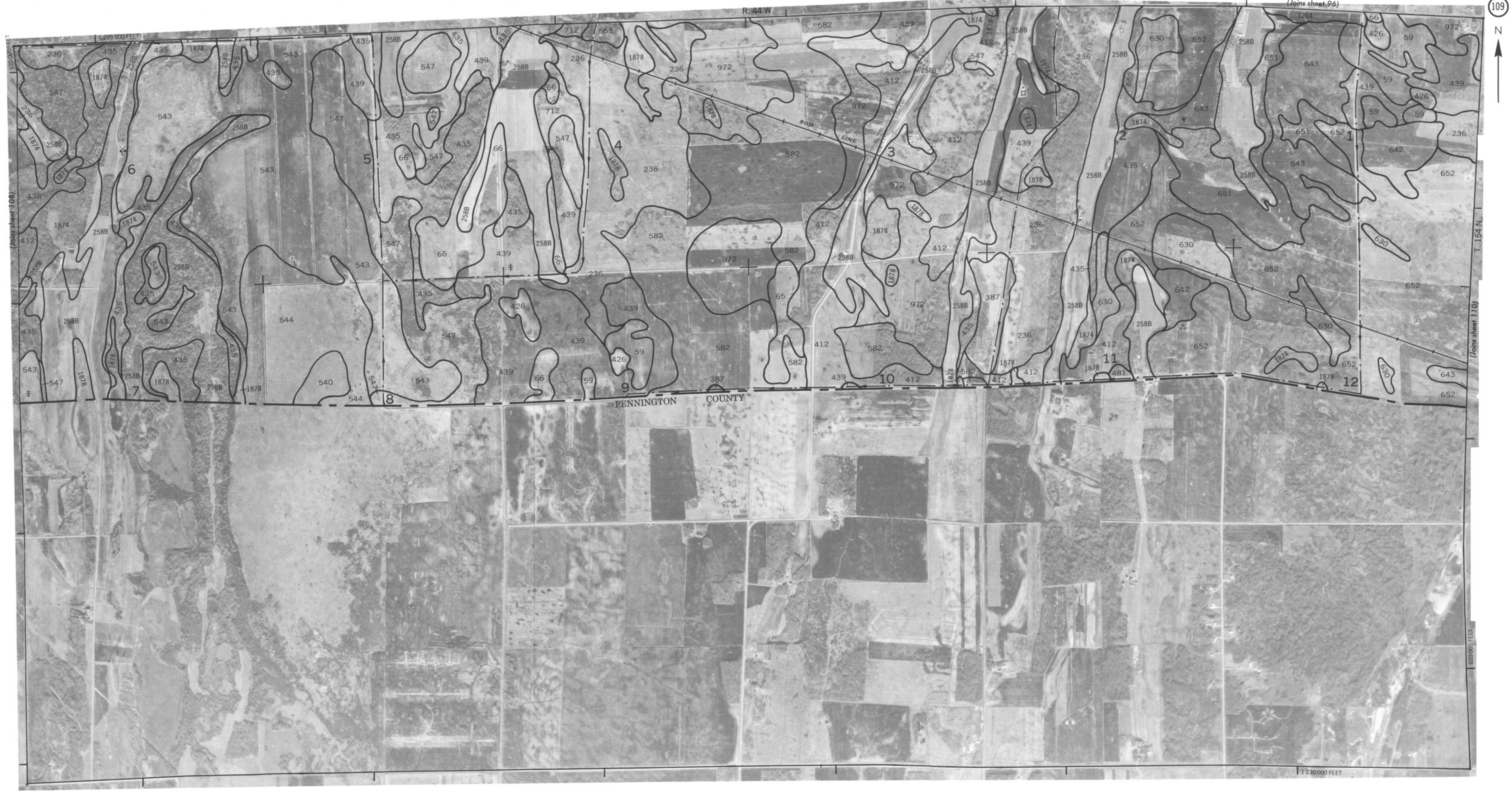

105
N
(Joins sheet 92)
(Joins sheet 104)
(Joins sheet 106)
1 085 000 FEET
640 000 FEET
620 000 FEET
1 110 000 FEET
R. 48 W.
R. 47 W.
T. 154 N.
SOO LINE
WARREN
BURLINGTON NORTHERN
75
Snake River
POLK COUNTY
1
2
3
4
5
6
7
8
9
10
11
12
47
57A
67A
67B
93A
157A
157B
418
935
1006
1299
1304A
1315A
1963
1964


N
(Joins sheet 93)
(Joins sheet 105)
(Joins sheet 107)
R. 47 W.
R. 46 W.
T. 154 N.
1 140 000 FEET
635 000 FEET
625 000 FEET
1 115 000 FEET
WARREN
AIRPORT
POLK COUNTY
1
2
3
4
5
6
7
8
9
10
11
12
1315A
1304A
1264
66
59
426
439
712
1299
547
236
481
1874
412
418
582
184A
372
563
2588
1804
435

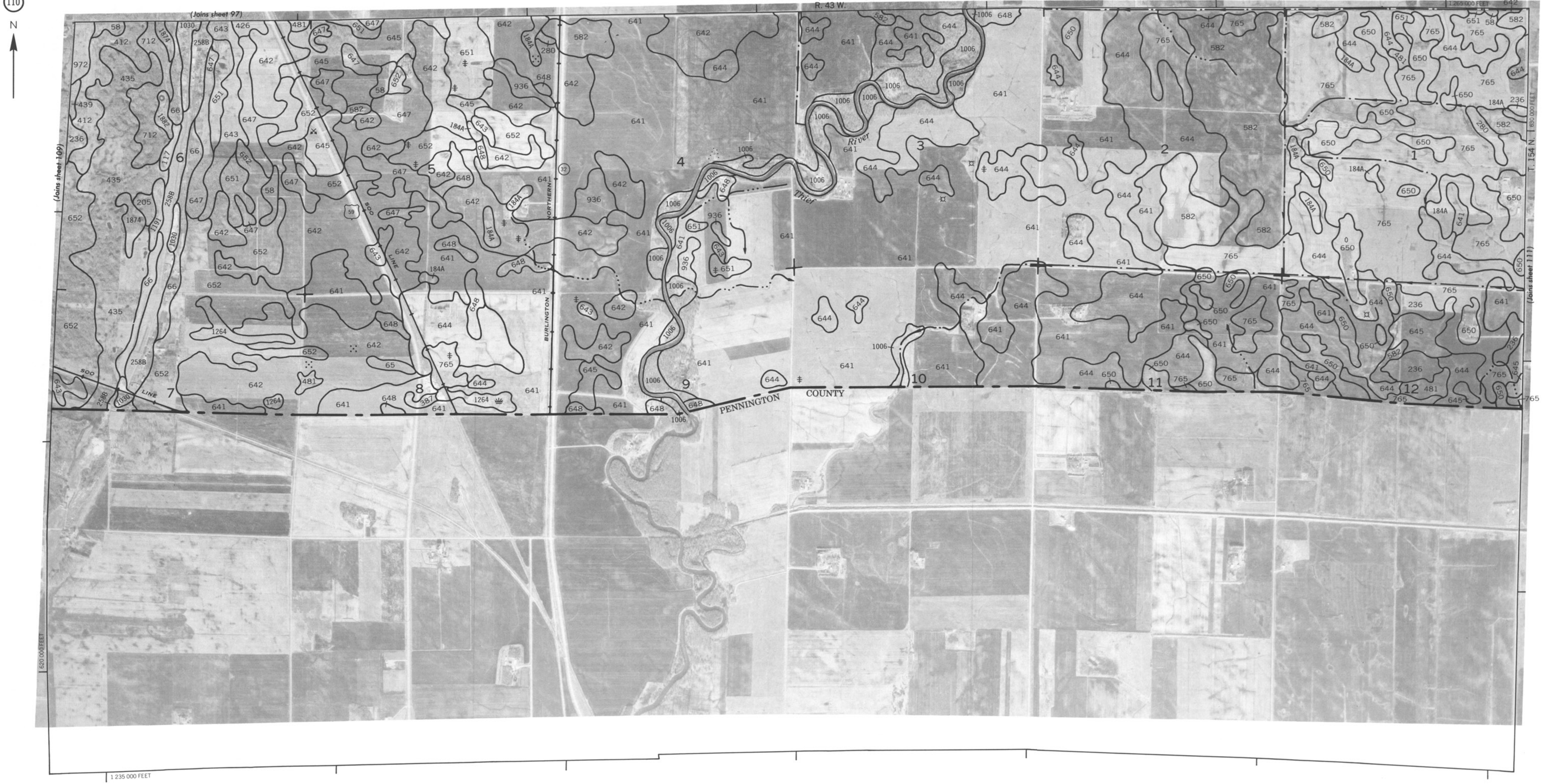


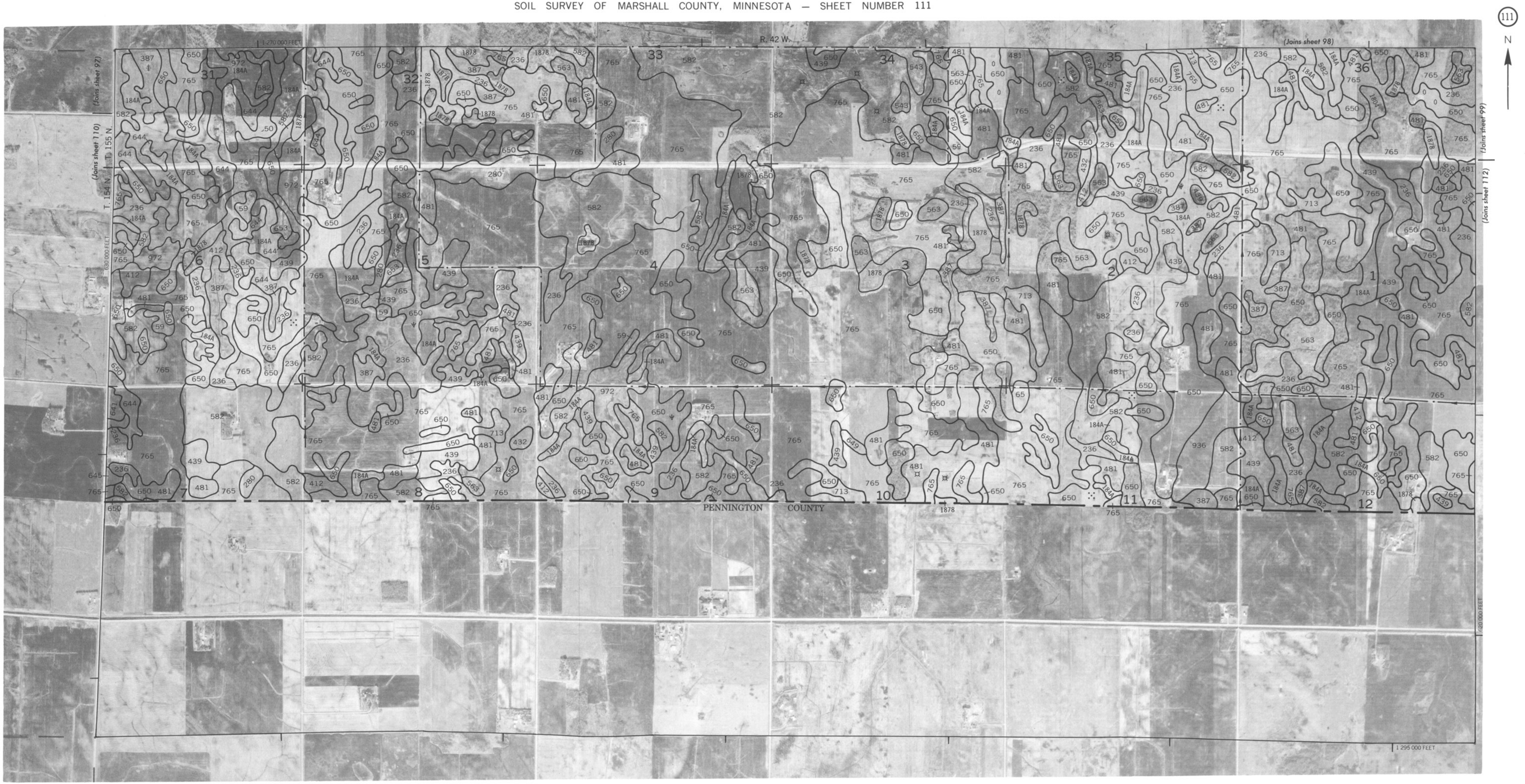
N
1 145 000 FEET
R. 46 W.
(Joins sheet 94)
(Joins sheet 108)
(Joins sheet 106)
T. 154 N.
635 000 FEET
625 000 FEET
1 170 000 FEET
POLK COUNTY
1
2
3
4
5
8
9
10
11
12
59
66
236
412
426
439
582
712
1030
1264
1299
1304A
1874
258B
2588


N
R. 45 W.
(Joins sheet 95)
(Joins sheet 107)
(Joins sheet 109)
1 200 000 FEET
T. 154 N.
625 000 FEET
1 175 000 FEET
PENNINGTON COUNTY
1
2
3
4
5
6
7
8
9
10
11
12
59
65
66
148
236
258B
372
387
412
426
432
435
439
481
543
547
582
712
972
1030
1264
1808
1874
1878
1882

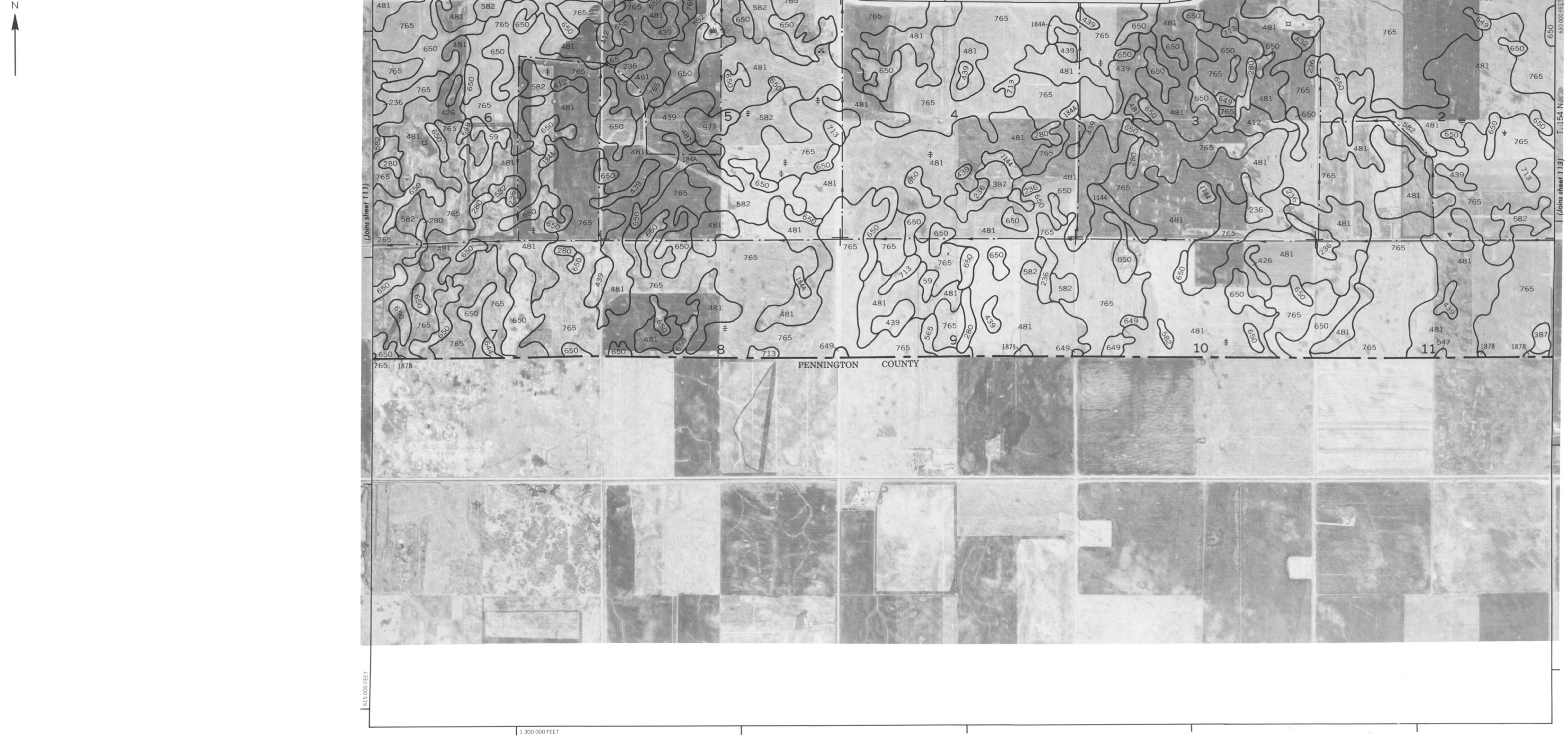

R. 44 W.
(Joins sheet 96)
(Joins sheet 108)
(Joins sheet 110)
T. 154 N.
N
1 205 000 FEET
1 230 000 FEET
620 000 FEET
SOO LINE
PENNINGTON COUNTY
1
2
3
4
5
6
7
8
9
10
11
12
59
65
66
236
258B
387
412
426
435
439
481
540
543
544
547
563
582
630
642
643
651
652
712
972
1264
1874
1878

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 110

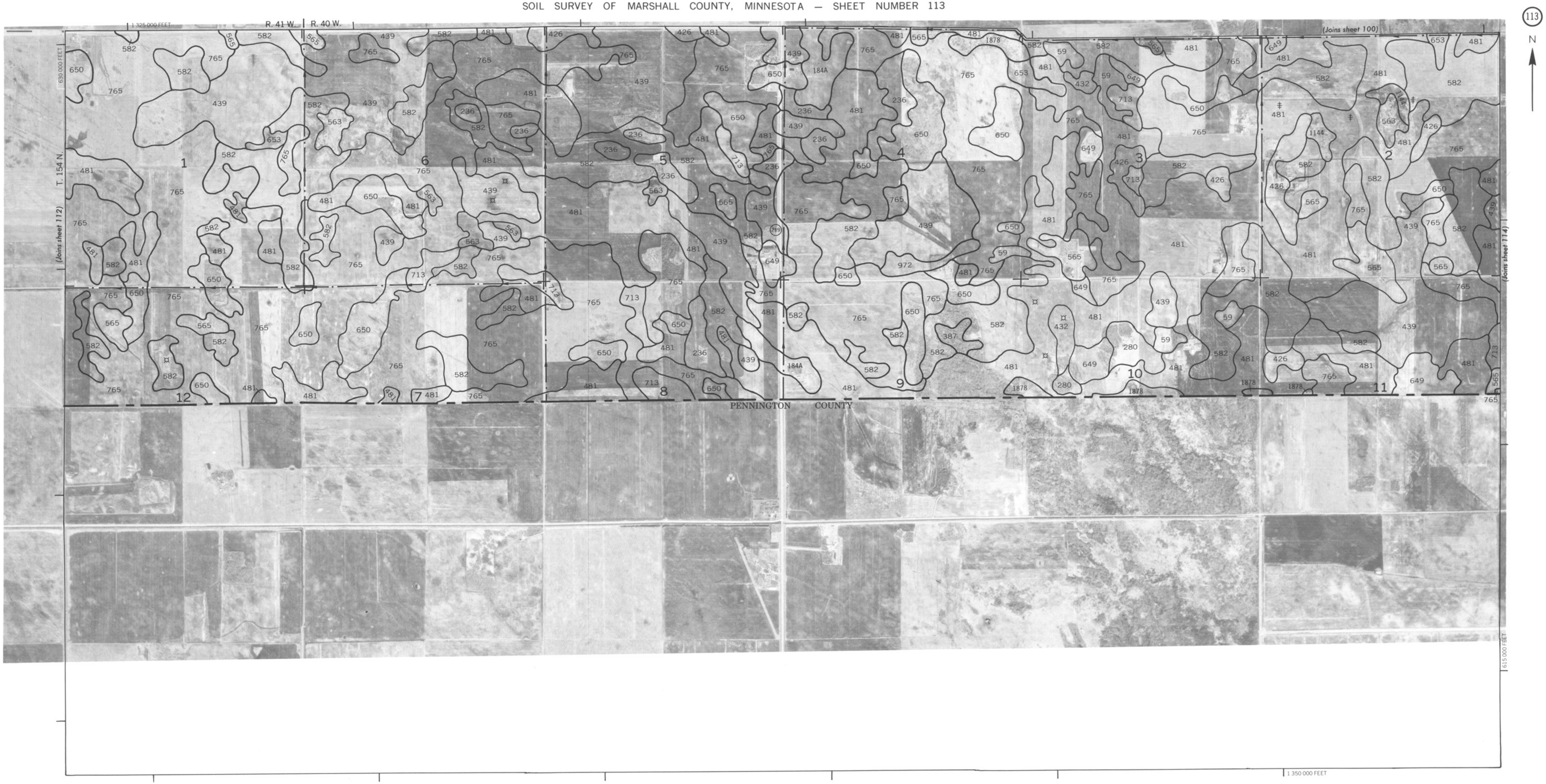

N
(Joins sheet 97)
R. 43 W.
1 265 000 FEET
850 000 FEET
T. 154 N.
(Joins sheet 109)
(Joins sheet 111)
620 000 FEET
1 235 000 FEET
SOO LINE
59
32
BURLINGTON NORTHERN
Thief River
PENNINGTON COUNTY
1
2
3
4
5
6
7
8
9
10
11
12


111
N
R. 42 W.
(Joins sheet 98)
(Joins sheet 97)
(Joins sheet 110)
(Joins sheet 99)
(Joins sheet 112)
T. 155 N.
T. 154 N.
1 270 000 FEET
630 000 FEET
620 000 FEET
1 295 000 FEET
PENNINGTON COUNTY
31
32
33
34
35
36
6
5
4
3
2
1
7
8
9
10
11
12

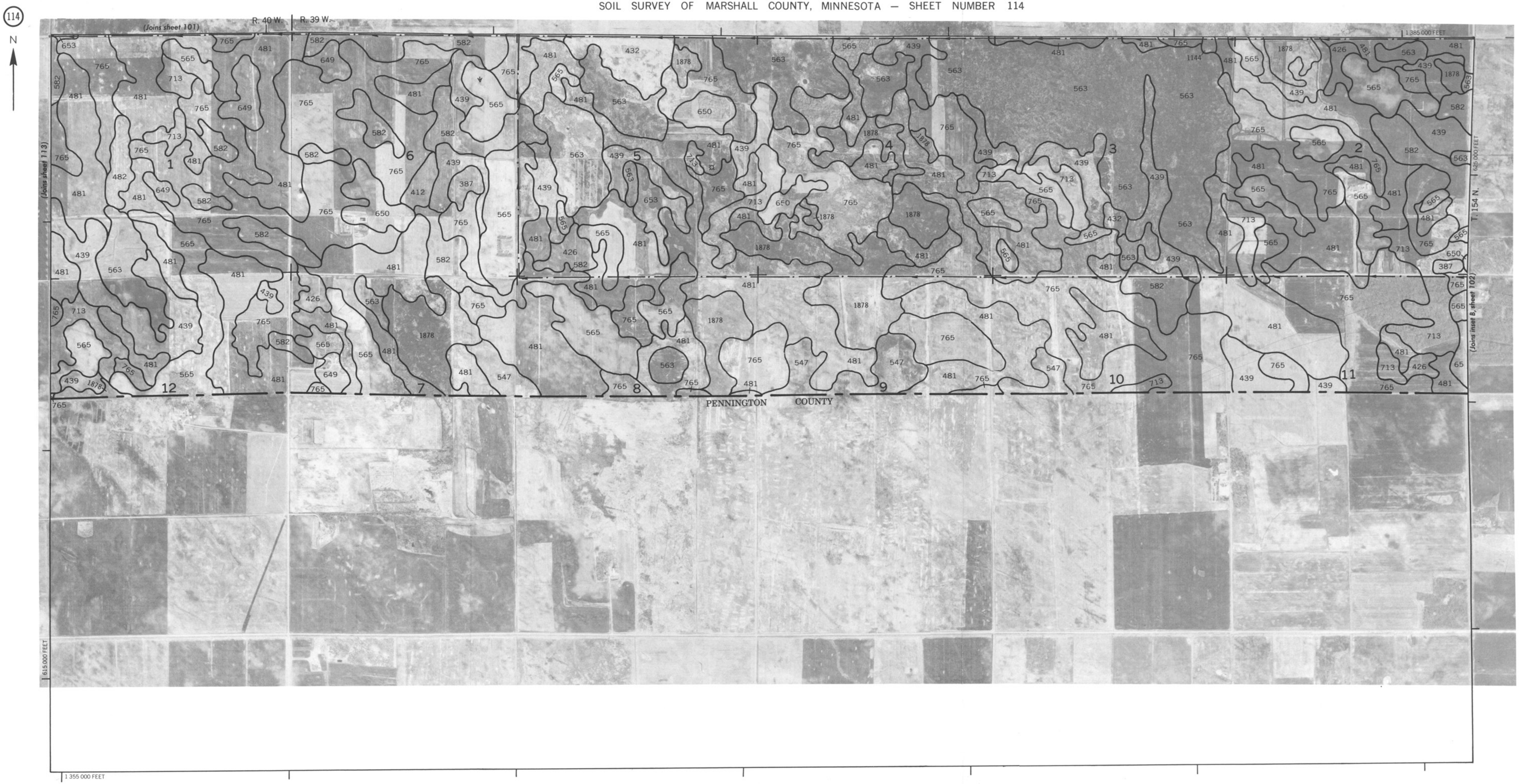
SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 112


N
(Joins sheet 99)
R. 41 W.
1 320 000 FEET
630 000 FEET
T. 154 N.
(Joins sheet 111)
(Joins sheet 113)
6
5
4
3
2
7
8
9
10
11
PENNINGTON COUNTY
615 000 FEET
1 300 000 FEET

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 113


113
N
1 325 000 FEET
R. 41 W.
R. 40 W.
630 000 FEET
T. 154 N.
(Joins sheet 100)
(Joins sheet 112)
(Joins sheet 114)
PENNINGTON COUNTY
615 000 FEET
1 350 000 FEET
1
2
3
4
5
6
7
8
9
10
11
12
59
184A
236
280
387
426
432
439
481
563
565
582
649
650
653
713
765
972
1144
1878

SOIL SURVEY OF MARSHALL COUNTY, MINNESOTA — SHEET NUMBER 114



114
N
(Joins sheet 101)
R. 40 W.
R. 39 W.
1 385 000 FEET
(Joins sheet 113)
(Joins inset B, sheet 102)
T. 154 N.
625 000 FEET
615 000 FEET
1 355 000 FEET
PENNINGTON COUNTY
1
2
3
4
5
6
7
8
9
10
11
12